Geo

Service Manual

Digital Edition

1990
METRO

ST370-90

1990 Geo METRO
SERVICE MANUAL

FOREWORD

This manual provides information on diagnosis, service procedures, adjustments, and specifications for the 1990 Geo Metro.

An understanding of the material contained in this manual and in the appropriate Dealer Service Bulletins will help technicians to better service vehicle owners.

When reference is made in this manual to a brand name, number, or specific tool, an equivalent product may be used in place of the recommended item.

All information, illustrations, and specifications contained in this literature are based on the latest product information available at the time of publication approval. The right is reserved to make changes at any time without notice.

NOTICE: When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are not reused, and those requiring thread locking compound, will be called out. The correct torque value must be used when installing fasteners that require it. If the above conditions are not followed, parts or system damage could result.

CHEVROLET-PONTIAC-CANADA GROUP
General Motors Corporation
WARREN, MICHIGAN

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ST370-90

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1990 SERVICE MANUAL COMMENT FORM

Use this form to advise us of any errors you might find in this manual. We also welcome suggestions for improving the Chevrolet Service Manual.

Service Manual(s) that have the error __________

Page number(s) that have the error __________

Figure number(s) that have the error __________

VIN (if available) or model and applicable options __________

Describe in detail, the error found or the suggestion(s). Attach additional pages if necessary.

From: Dealer Firm Name __________ Dealer Code __________
City / Town __________ State __________
Name of Person Submitting This Comment Form __________
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Mail To: Customer Satisfaction
G-30-5
Chevrolet C. O. Building
30007 Van Dyke Ave.
Warren, MI. 48090

SECTION 0A

GENERAL INFORMATION

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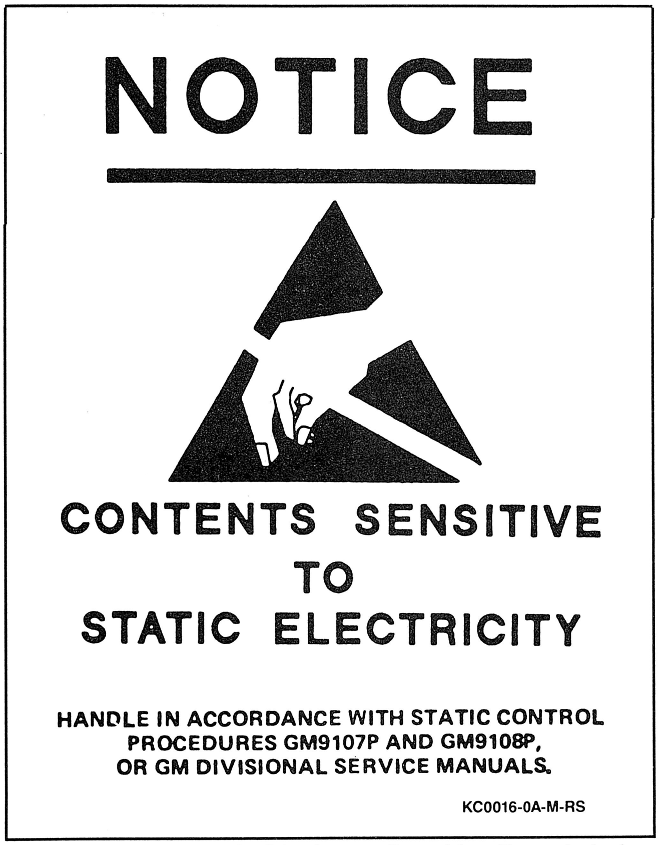
HANDLING ELECTROSTATIC DISCHARGE (ESD) SENSITIVE PARTS

NOTICE: When handling an electronic part that has an ESD sensitive sticker (Figure 1), the service technician should follow these guidelines to reduce any possible electrostatic charge build-up on the service technicians's body and the electronic part in the dealership:

1. Do not open package until it is time to install the part.
2. Avoid touching electrical terminals of the part.
3. Before removing the part from its package, ground the package to a known good ground on the car.
4. Always touch a known good ground before handling the part. This should be repeated while handling the part and more frequently after sliding across the seat, sitting down from a standing position or walking a distance.



NOTICE

CONTENTS SENSITIVE TO STATIC ELECTRICITY

HANDLE IN ACCORDANCE WITH STATIC CONTROL PROCEDURES GM9107P AND GM9108P, OR GM DIVISIONAL SERVICE MANUALS.

KC0016-0A-M-RS

Figure 1 Electrostatic Discharge Sensitive Parts Label

BODY INDENTIFICATION

The body number plate identifies the identification numbers and model year, build date code, car division, series, style, body assembly plant, plant number, paint color codes, type of paint, trim combination, modular seat code, and roof option. The I.D. plate is located on the cowl top panel.

VEHICLE IDENTIFICATION PLATE

The vehicle identification number is on the left upper instrument panel (Figure 2). The sequential unit number is prefixed by letters and numbers which are explained in Figure 3.

MODEL IDENTIFICATION

The model series and body styles for the current year are listed in Figure 3.

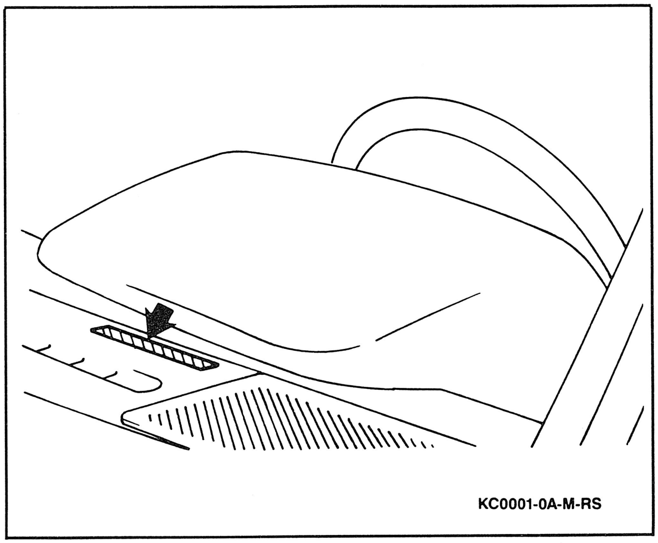


Figure 2 Vehicle Identification Number Location

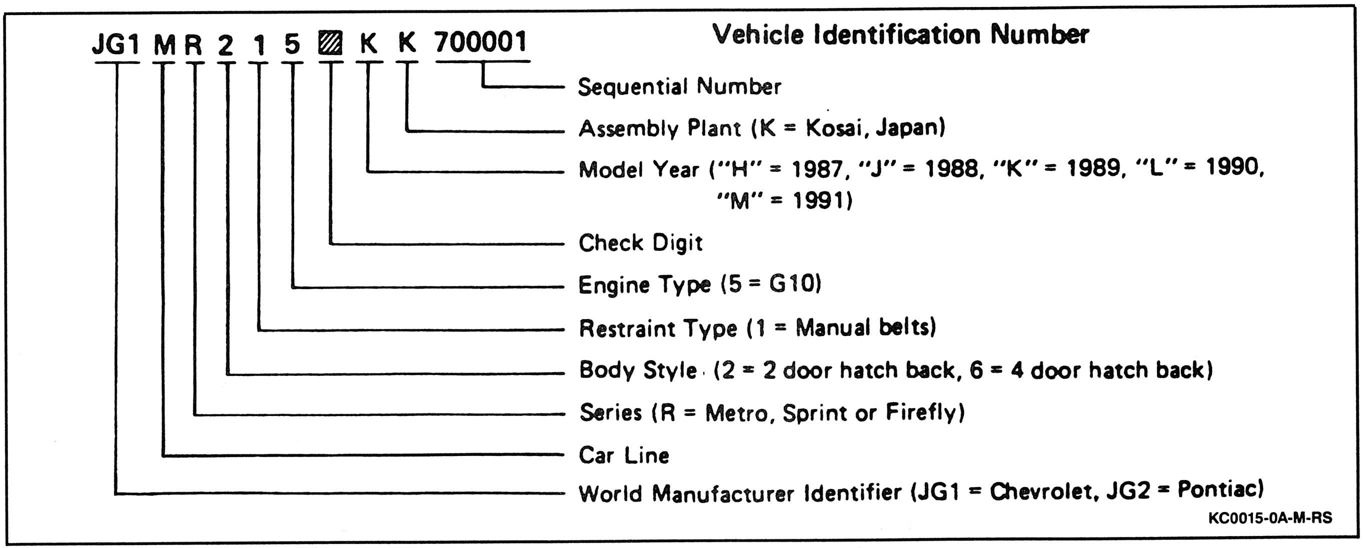

JG1 M R 2 1 5 ▨ K K 700001
Vehicle Identification Number
Sequential Number
Assembly Plant (K = Kosai, Japan)
Model Year ("H" = 1987, "J" = 1988, "K" = 1989, "L" = 1990, "M" = 1991)
Check Digit
Engine Type (5 = G10)
Restraint Type (1 = Manual belts)
Body Style (2 = 2 door hatch back, 6 = 4 door hatch back)
Series (R = Metro, Sprint or Firefly)
Car Line
World Manufacturer Identifier (JG1 = Chevrolet, JG2 = Pontiac)
KC0015-0A-M-RS

Figure 3 Vehicle Identification Number

ENGINE IDENTIFICATION

The Vehicle Identification Chart (Figure 3) provides detailed VIN code information by liter and by the Engine Code letter located on the vehicle indentification plate.

The stick-on labels attached to the engine, or laser etching or stampings of the engine block, indicate the engine unit number or date code.

All engines and transaxles are stamped with a partial VIN. The stamping contains nine positions.

The first position is the GM car division identification.

1 = Chevrolet
2 = Pontiac
3 = Oldsmobile
4 = Buick
6 = Cadillac

The second position is the model year.

K = 1989

The third position is the vehicle assembly plant code.

Fourth through ninth position is the assembly plant sequential number of the car.

TIRE INFORMATION

Information on the tire size, vehicle capacity weight and recommended tire inflation pressure is listed on the Tire Placard that is located on the edge of the left door lock pillar. The tire pressure specifications are also shown in Section OB.

GENERAL VEHICLE LIFTING AND JACKING

Precautions Against Tipping

On front-wheel drive vehicles, the centerline-of-gravity is further forward than on rear-wheel drive vehicles. Therefore, **whenever removing major components from the rear** of the vehicle, while supported on a hoist, it is **mandatory** to support the vehicle in a manner to prevent the possibility of the vehicle tipping forward (Figures 4 through 7).

CAUTION: Failure to follow the procedures outlined may result in unsatisfactory car performance, or a durability failure which may result in loss of control of car. Lifting should only be done at the positions indicated in figures to prevent possible damage to the car. If the vehicles to be jacked up only at the front or rear end, be sure to block the wheels in order to ensure safety. After the vehicle is jacked up, be sure to support it on stands. It is extremely dangerous to do any work on the vehicle raised on jack alone.

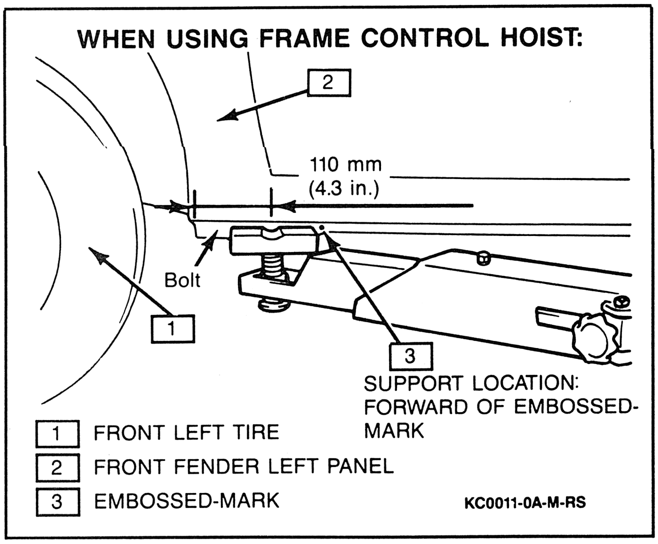

WHEN USING FRAME CONTROL HOIST:
2
110 mm
(4.3 in.)
Bolt
1
3
SUPPORT LOCATION: FORWARD OF EMBOSSED-MARK
1 FRONT LEFT TIRE
2 FRONT FENDER LEFT PANEL
3 EMBOSSED-MARK
KC0011-0A-M-RS

Figure 4 Front Support Location

METRIC FASTENERS

This vehicle is primarily dimensioned in the metric system. Most fasteners are metric and are close in dimension to well-known customary fasteners in the inch system. It is important that replacement fasteners

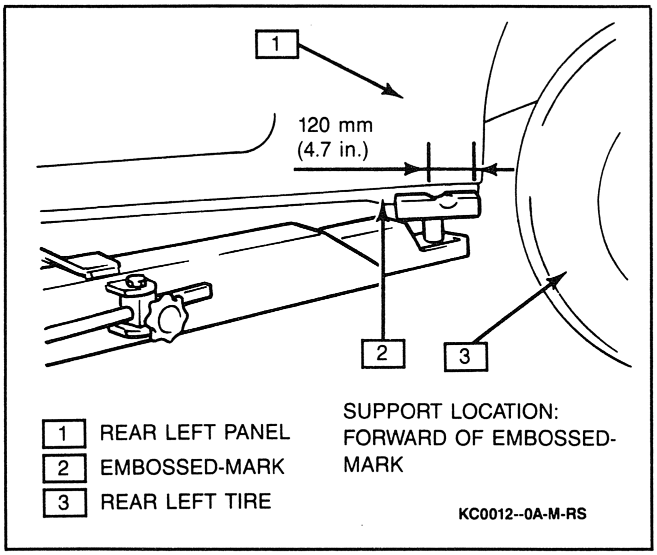


Figure 5 Rear Support Location

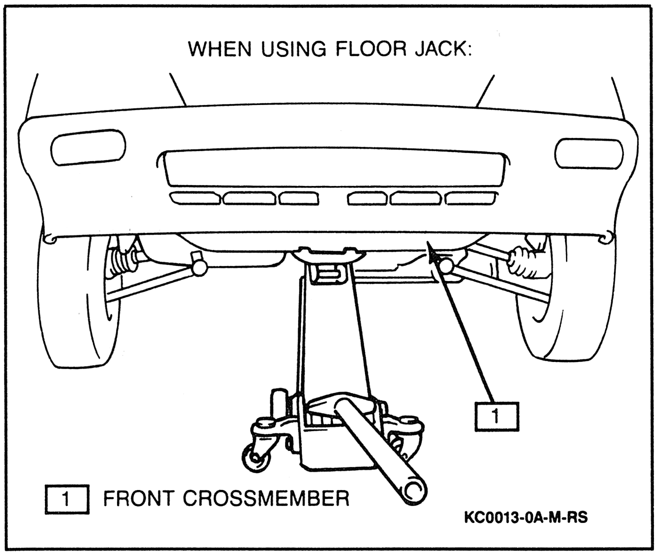


Figure 6 Front Support Location

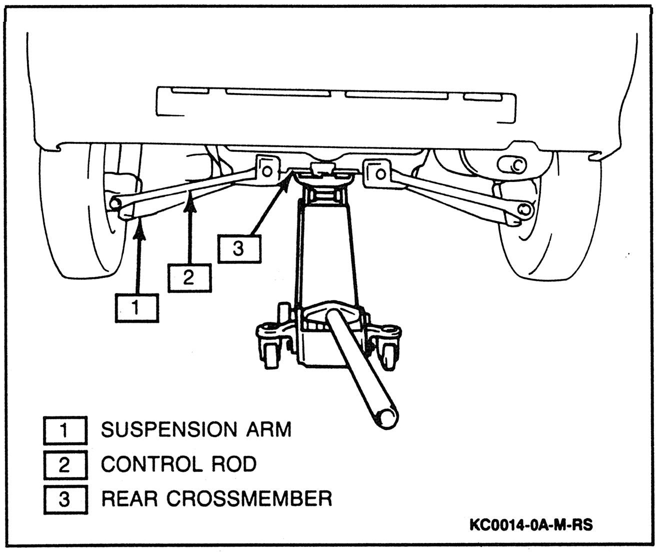


Figure 7 Rear Support Location

be of the correct nominal diameter, thread pitch and strength.

Original equipment metric (except "beauty" bolts, those bolts exposed on bumpers and cross-recess head screws) are identified by a number marking which indicates the strength of the material in the fastener.

General Motors Engineering Standards, along with other North American Industries, have adopted a portion of the standard metric fastener sizes defined by ISO (International Standards Organization). This was done to reduce the number of fastener sizes used and yet retain the best strength qualities in each thread size. For example, the customary 1/4-20 and 1/4-28 screws are replaced by the metric M6.0 X1 screw which has nearly the same diameter and 25.4 threads per inch. The thread pitch is in between the customary coarse and fine thread pitches. Metric and customary thread notation differ slightly. The difference is shown in Figure 8.

FASTENER STRENGTH INDENTIFICATION

Most commonly used metric fastener strength property classes are 4T, 7T and radial line with the class identification embossed on the head of each bolt. Some metric nuts will be marked with punch mark strength identification on the nut face. Figure 11 shows the different strength markings.

When replacing metric fasteners, be careful to use bolts and nuts of the same strength or greater than the original fasteners (the same number marking or higher). It is likewise important to select replacement fasteners of the correct size.

Correct replacement bolts and nuts are available through the parts division. Many metric fasteners available in the aftermarket parts channels were designed to metric standards of countries other than the United States, and may be of lower strength, may not have the same numbered head marking system, and may be of a different thread pitch.

The metric fasteners used on GM products are not designed to new, international standards thay may not yet be manufactured by some non-domestic bolt and nut suppliers. In general, except for special applications, the common sizes and pitches are shown in Figure 11.

NOTICE: The designations of the standard fasteners used on this car are of coarse screw thread up to M8 and fine screw thread beyond M10. As can be seen in the tables, the designation to pitch relations are somewhat different between coarse screw thread and fine screw thread. Therefore, when replacing fasteners, the pitch should be confirmed carefully even if the replacement fasteners is the same metric fastener.

TRANSAXLE IDENTIFICATION

Figure 13 shows how to determine the model and serial number of an automatic transaxle.

Figure 13 shows how to determine the model and serial number of a manual transaxle.

PREVAILING TORQUE FASTENERS

A prevailing torque nut is designed to develop an interference between the nut and bolt threads. This is

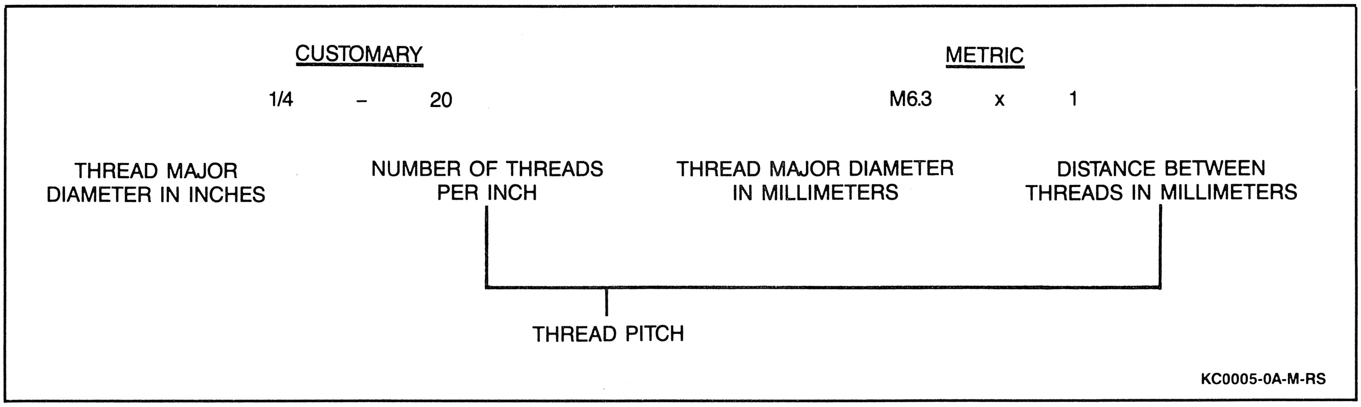

CUSTOMARY
1/4 - 20
METRIC
M6.3 x 1
THREAD MAJOR DIAMETER IN INCHES
NUMBER OF THREADS PER INCH
THREAD MAJOR DIAMETER IN MILLIMETERS
DISTANCE BETWEEN THREADS IN MILLIMETERS
THREAD PITCH
KC0005-0A-M-RS

Figure 8 Thread Notation

METRIC COARSE SCREW THREADS				METRIC FINE SCREW THREADS			
Designation of screw thread	Pitch (mm)	Designation of screw thread	Pitch (mm)	Designation of screw thread	Pitch (mm)	Designation of screw thread	Pitch (mm)
M1.6	0.35	M12	1.75			M12x1.25	1.25
M2	0.4	M14	2			M14x1.5	1.5
M2.2	0.45	M16	2			M16x1.5	1.5
M2.5	0.45	M18	2.5			M18x1.5	1.5
M3x0.5	0.5	M20	2.5			M20x1.5	1.5
M3.5	0.6	M22	2.5			M22x1.5	1.5
M4x0.7	0.7	M24	3			M24x2	2
M4.5	0.75	M27	3			M27x2	2
M5x0.8	0.8	M30	3.5			M30x2	2
M6	1	M33	3.5			M33x2	2
M7	1	M36	4			M36x3	3
M8	1.25	M39	4	M8x1	1	M39x3	3
M10	1.5			M10x1.25	1.25		

KC0004-0A-M-RS

Figure 9 Metric Screw Table

most often accomplished by distortion of the top of an all metal nut or by using a nylon patch on the threads in the middle of the hex flat. A nylon insert may also be used as a method of interference between nut and bolt threads (Figure 16).

A prevailing torque bolt is designed to develop an interference between bolt and thread nuts, or the threads of a tapped hole. This is accomplished by distorting some of the threads or by using a nylon patch or adhesive (Figure 16).

Recommendations for Reuse

1. Clean, unrusted prevailing torque nuts and bolts may be reused as follows:
    a. Clean dirt and other foreign material off nuts or bolts.
    b. Inspect nuts or bolts to ensure there are no cracks, elongation, or other signs of abuse or overtightening. (If there is any doubt, replace with a new prevailing torque fastener of equal or greater strength).
    c. Assemble parts and hand start nuts or bolts.
    d. Observe that before fastener seats, it develops torque per the chart in Figure 10. (If there is any doubt, replace with a new prevailing torque fastener of equal or greater strength).
    e. Tighten fastener to torque specified in appropriate section of this manual.
2. Bolts and nuts which are rusty or damaged should be replaced with new parts of equal or greater strength.

METRIC SIZES								
		6 & 6.3	8	10	12	14	16	20
NUTS AND ALL METAL BOLTS	N·m	0.4	0.8	1.4	2.2	3.0	4.2	7.0
	In. Lbs.	4.0	7.0	12	18	25	35	57
ADHESIVE OR NYLON COATED BOLTS	N·m	0.4	0.6	1.2	1.6	2.4	3.4	5.6
	In. Lbs.	4.0	5.0	10	14	20	28	46

INCH SIZES									
		.250	.312	.375	.437	.500	.562	.625	.750
NUTS AND ALL METAL BOLTS	N·m	0.4	0.6	1.4	1.8	2.4	3.2	4.2	6.2
	In. Lbs.	4.0	5.0	12	15	20	27	35	51
ADHESIVE OR NYLON COATED BOLTS	N·m	0.4	0.6	1.0	1.4	1.8	2.6	3.4	5.2
	In. Lbs.	4.0	5.0	9.0	12	15	22	28	43

KC0008-0A-M-RS

Figure 10 Torque Chart

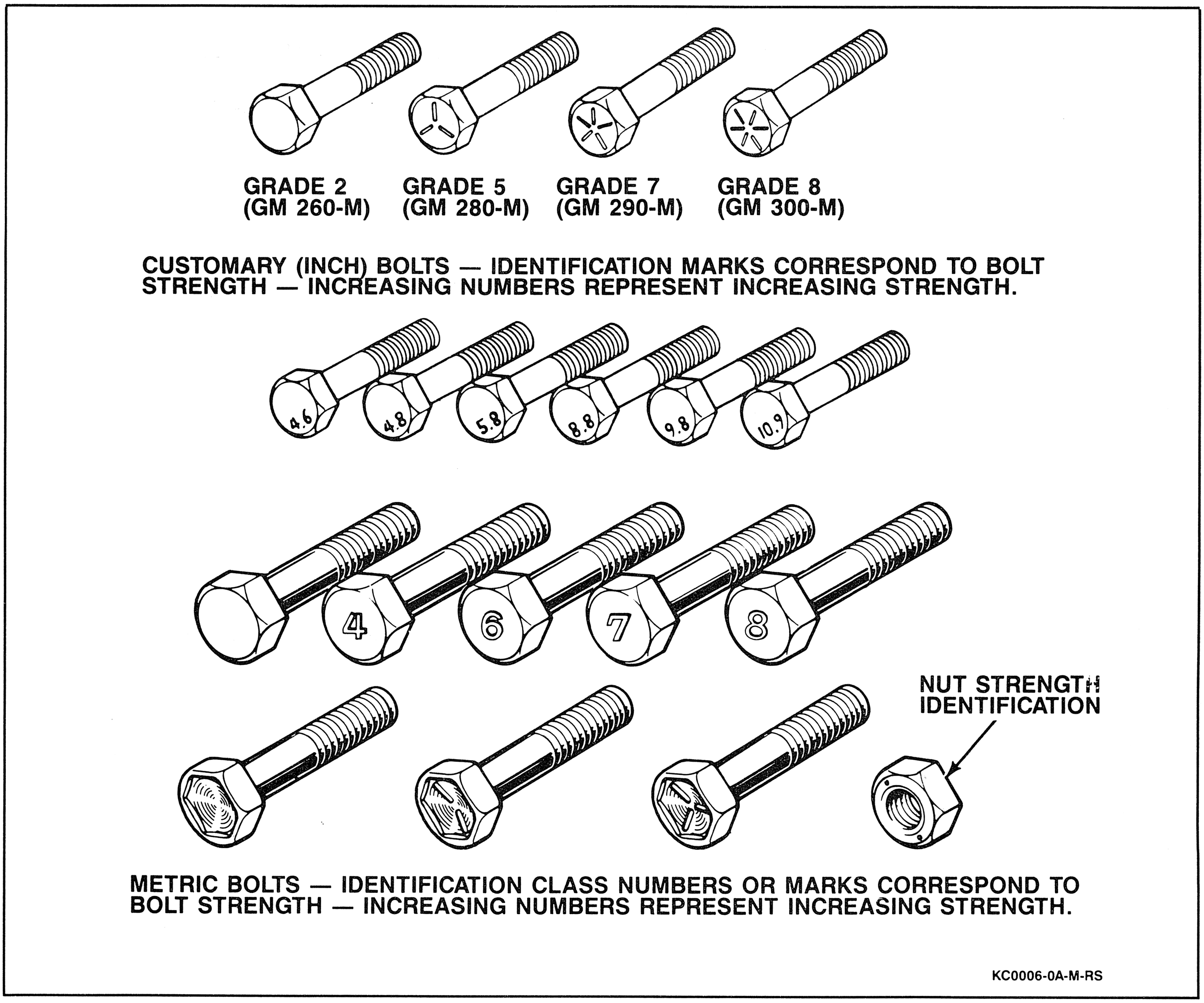

GRADE 2
(GM 260-M)
GRADE 5
(GM 280-M)
GRADE 7
(GM 290-M)
GRADE 8
(GM 300-M)
CUSTOMARY (INCH) BOLTS — IDENTIFICATION MARKS CORRESPOND TO BOLT STRENGTH — INCREASING NUMBERS REPRESENT INCREASING STRENGTH.
4.6
4.8
5.8
8.8
9.8
10.9
4
6
7
8
NUT STRENGTH IDENTIFICATION
METRIC BOLTS — IDENTIFICATION CLASS NUMBERS OR MARKS CORRESPOND TO BOLT STRENGTH — INCREASING NUMBERS REPRESENT INCREASING STRENGTH.
KC0006-0A-M-RS

Figure 11 Bolt Strength Markings

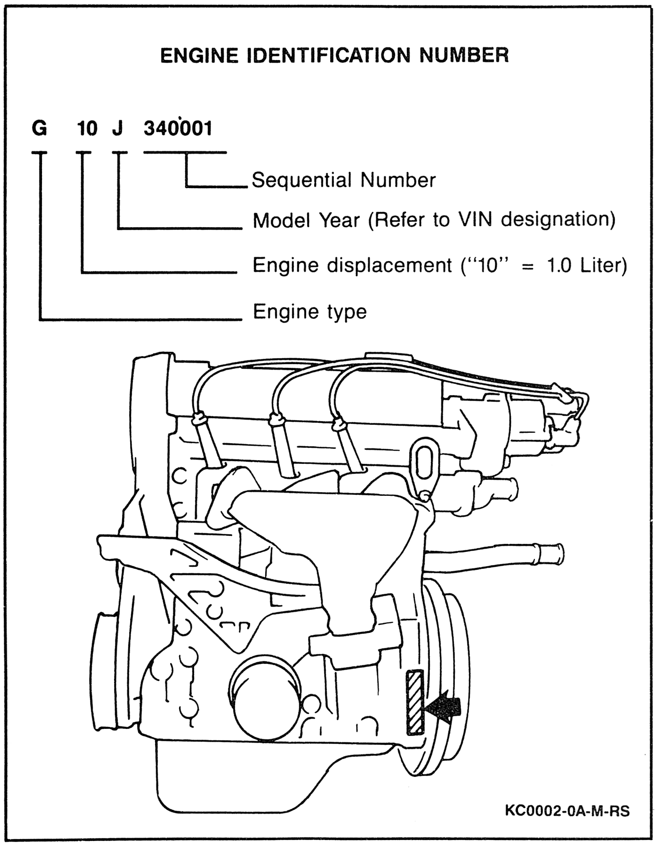

ENGINE IDENTIFICATION NUMBER
G 10 J 340001
Sequential Number
Model Year (Refer to VIN designation)
Engine displacement ("10" = 1.0 Liter)
Engine type
KC0002-0A-M-RS

Figure 12 Engine Identification Number Location

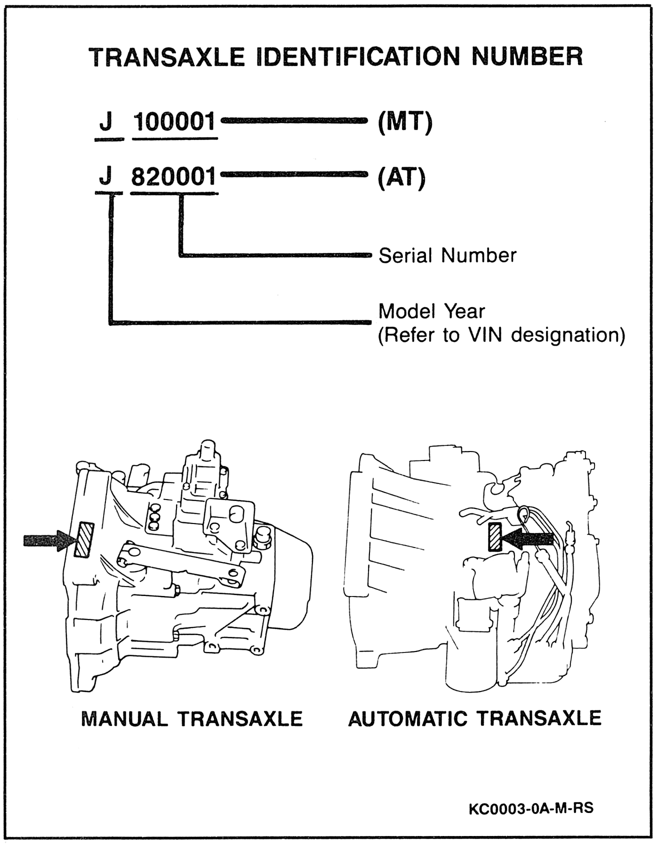
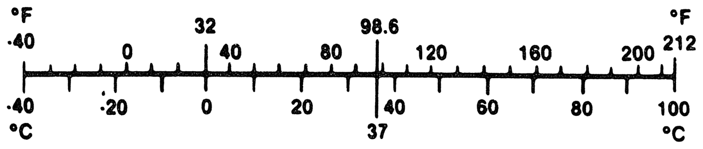

TRANSAXLE IDENTIFICATION NUMBER
J 100001 (MT)
J 820001 (AT)
Serial Number
Model Year
(Refer to VIN designation)
MANUAL TRANSAXLE
AUTOMATIC TRANSAXLE
KC0003-0A-M-RS

Figure 13 Transaxle Identification Number Location

SI METRIC-CUSTOMARY CONVERSION TABLE

Multiply	by	to get equivalent number of:
	LENGTH	
Inch	25.4	millimeters (mm)
Foot	0.304	meters (m)
Yard	0.914	meters
Mile	1.609	kilometers (km)
	AREA	
Inch^2	645.2	millimeters^2 (mm^2)
	6.45	centimeters^2 (cm^2)
Foot^2	0.092	meters^2 (m^2)
Yard^2	0.836	meters^2
	VOLUME	
Inch^3	16 387.	mm^3
	16.387	cm^3
	0.016	liters (l)
Quart	0.946	liters
Gallon	3.785	liters
Yard^3	0.764	meters^3 (m^3)
	MASS	
Pound	0.453	kilograms (kg)
Ton	907.18	kilograms (kg)
Ton	0.907	tonne (t)
	FORCE	
Kilogram	9.807	newtons (N)
Ounce	0.278	newtons
Pound	4.448	newtons
	TEMPERATURE	
Degree Fahrenheit	(°F-32) ÷ 1.8	degree Celsius (C)



J20025-0A-T

Multiply	by	to get equivalent number of:
	ACCELERATION	
Foot/sec^2	0.304	meter/sec^2 (m/s^2)
Inch/sec^2	0.025	meter/sec^2
	TORQUE	
Pound-inch	0.112	newton-meters (N-m)
Pound-foot	1.355	newton-meters
	POWER	
Horsepower	0.746	kilowatts (kW)
	PRESSURE OR STRESS	
Inches of mercury	3.377	kilopascals (kPa)
Pounds/sq. in.	6.895	kilopascals
	ENERGY OR WORK	
BTU	1 055.	joules (J)
Foot-pound	1.355	joules
Kilowatt-hour	3 600 000. or 3.6x10^6	joules (J = one W's)
	LIGHT	
Foot candle	10.764	lumens/meter^2 (lm/m^2)
	FUEL PERFORMANCE	
Miles/gal	0.425	kilometers/liter (km/l)
Gal/mile	2.352	liters/kilometer (l/km)
	VELOCITY	
Miles/hour	1.609	kilometer/hr. (km/h)

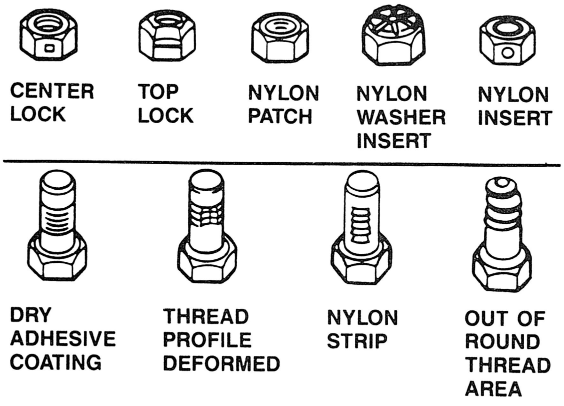
Figure 14 Metric English Conversion Table

DECIMAL AND METRIC EQUIVALENTS

Fractions	Decimal In.	Metric MM.	Fractions	Decimal In.	Metric MM.
1/64	.015625	.39688	33/64	.515625	13.09687
1/32	.03125	.79375	17/32	.53125	13.49375
3/64	.046875	1.19062	35/64	.546875	13.89062
1/16	.0625	1.58750	9/16	.5625	14.28750
5/64	.078125	1.98437	37/64	.578125	14.68437
3/32	.09375	2.38125	19/32	.59375	15.08125
7/64	.109375	2.77812	39/64	.609375	15.47812
1/8	.125	3.1750	5/8	.625	15.87500
9/64	.140625	3.57187	41/64	.640625	16.27187
5/32	.15625	3.96875	21/32	.65625	16.66875
11/64	.171875	4.36562	43/64	.671875	17.06562
3/16	.1875	4.76250	11/16	.6875	17.46250
13/64	.203125	5.15937	45/64	.703125	17.85937
7/32	.21875	5.55625	23/32	.71875	18.25625
15/64	.234375	5.95312	47/64	.734375	18.65312
1/4	.250	6.35000	3/4	.750	19.05000
17/64	.265625	6.74687	49/64	.765625	19.44687
9/32	.28125	7.14375	25/32	.78125	19.84375
19/64	.296875	7.54062	51/64	.796875	20.24062
5/16	.3125	7.93750	13/16	.8125	20.63750
21/64	.328125	8.33437	53/64	.828125	21.03437
11/32	.34375	8.73125	27/32	.84375	21.43125
23/64	.359375	9.12812	55/64	.859375	21.82812
3/8	.375	9.52500	7/8	.875	22.22500
25/64	.390625	9.92187	57/64	.890625	22.62187
13/32	.40625	10.31875	29/32	.90625	23.01875
27/64	.421875	10.71562	59/64	.921875	23.41562
7/16	.4375	11.11250	15/16	.9375	23.81250
29/64	.453125	11.50937	61/64	.953125	24.20937
15/32	.46875	11.90625	31/32	.96875	24.60625
31/64	.484375	12.30312	63/64	.984375	25.00312
1/2	.500	12.70000	1	1.00	25.40000

520014-0A

Figure 15 Decimal And Metric Equivalents

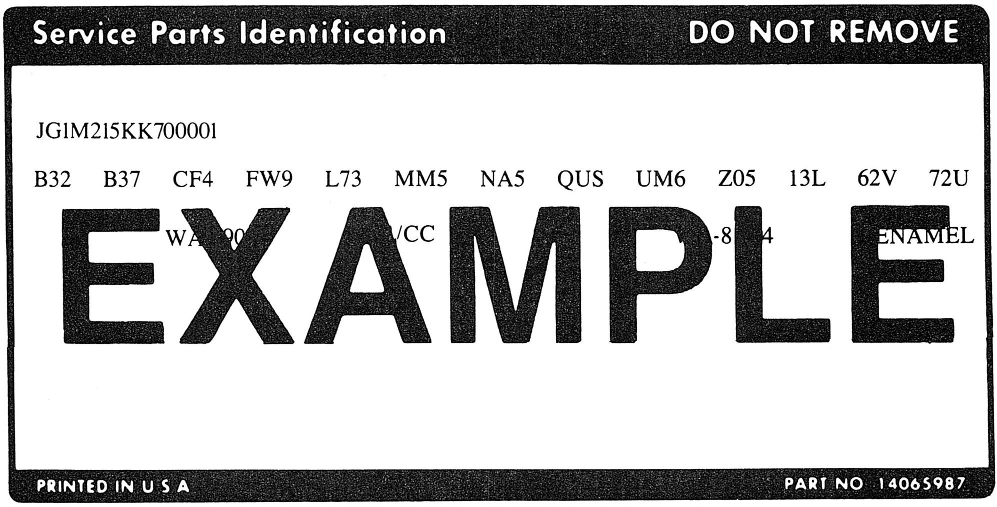

CENTER LOCK
TOP LOCK
NYLON PATCH
NYLON WASHER INSERT
NYLON INSERT
DRY ADHESIVE COATING
THREAD PROFILE DEFORMED
NYLON STRIP
OUT OF ROUND THREAD AREA

KC0007-0A-M-RS

Figure 16 Prevailing Torque Fasteners

SERVICE PARTS IDENTIFICATION LABEL

The Service Parts Identification Label provides identification of vehicle equipment to assist in servicing and determining replacement parts. Included on this label will be regular production options (RPO's) as well as standard and mandatory options. This label is located on the glove box door. For additional information on the Service Parts Identification Label, see a GM Parts Catalog.



Service Parts Identification DO NOT REMOVE

JG1M215KK700001

B32 B37 CF4 FW9 L73 MM5 NA5 QUS UM6 Z05 13L 62V 72U

WA 90 /CC -8 4 ENAMEL

EXAMPLE

PRINTED IN U S A PART NO 14065987

KC0017-0A-M-RS

Figure 17 Service Parts Identification Label

SECTION 0B
MAINTENANCE AND LUBRICATION
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Owner Inspections and Services 0B-5
Recommended Fluids and Lubricants 0B-7
Maintenance Items 0B-7
Approximate Fluid Capacities 0B-7
Tire Pressure Specifications 0B-7

NORMAL CAR USE

The maintenance instructions contained in the Maintenance Schedule are based on the assumption that the car will be used as designed:

- To carry passengers and cargo within the limitation indicated on the Tire Placard located on the driver's door or door lock pillar,
- On reasonable road surfaces within legal operating limits,
- On unleaded gasoline.

SCHEDULE I

Fig. 1

Follow Schedule I if the car is operated under one or more of the following conditions:

- When most trips are less than 4 miles (6 km).
- Operating when outside temperatures remain below freezing and when most trips are less than 10 miles (16 km).
- When most trips include extended idling and/or frequent low-speed operation as in stop-and-go traffic.
- Operating in dusty areas.

Schedule I should also be followed if the car is used in delivery service, police, taxi or other commercial applications.

SCHEDULE II

Fig. 2

Follow Schedule II ONLY if none of the driving conditions specified in Schedule I apply.

EXPLANATION OF SCHEDULED MAINTENANCE SERVICES

Refer to Figs. 1 and 2 for the schedules of time and/or mileage intervals. The following text and illustrations (Figs. 3 and 4) give the details of the required maintenance services.

Engine Oil and Oil Filter Change

ALWAYS USE SG QUALITY ENERGY CONSERVING II OILS OF PROPER VISCOSITY

The "SG" designation may be shown alone or in combination with other designations such as "SG/CC," "SG/CD," "SF, SG, CC," etc.

Engine Oil Viscosity

Engine oil viscosity (thickness) has an effect on fuel economy and cold-weather operation (starting and oil flow). Lower viscosity engine oils can provide better fuel economy and cold-weather performance; however, higher temperature weather conditions require higher viscosity engine oils for satisfactory lubrication. **Using oils of any viscosity other than those viscosities recommended could result in engine damage.**

When choosing an oil, consider the range of temperatures the vehicle will be operated in before the next oil change. Then, select the recommended oil viscosity from the chart (Fig. 3).

Chassis Lubrication

Lubricate transaxle shift linkage. Lubricate parking brake cable guides, underbody contact points and linkage at every other oil change.

Do not lubricate the parking brake cables. Lubrication destroys the plastic coating on the cables.

Throttle Body Mounting Torque

Check torque of mounting bolts and/or nuts. Tighten TBI mounting bolts or nuts to 12 lbs. ft. (17 N·m). Tighten MPFI/SFI throttle body mounting bolts or nuts to 20 lbs. ft. (27 N·m).

Tire and Wheel Inspection and Rotation

Check tires for abnormal wear or damage. To equalize wear and obtain maximum tire life, rotate as shown in Fig. 4. If irregular or premature wear exists, check wheel alignment. Also, check for damaged wheels.

While the tires and wheels are removed, perform the brake system inspection specified at Brake System Inspection that appears after the heading "Each Time Oil Is Changed."

Water Pump Belt Inspection

Inspect the water pump belt tension and adjust as necessary.

SCHEDULED MAINTENANCE SERVICES
SCHEDULE I

Follow Schedule I if your vehicle is MAINLY operated under one or more of the following conditions:

- **When most trips are less than 4 miles (6 kilometers).**
- **When most trips are less than 10 miles (16 kilometers) and outside temperatures remain below freezing.**
- **When most trips include extended idling and/or frequent low-speed operation as in stop-and-go traffic.**
- **Operating in dusty areas.**

Schedule I should also be followed if the vehicle is used for delivery service, police, taxi or other commercial applications.

The services shown in this schedule up to 60 000 miles (100 000 km) are to be performed after 60 000 miles at the same intervals.

	TO BE SERVICED	WHEN TO PERFORM Miles (kilometers) or Months, Whichever Occurs First (Also, See Explanation of Services Pages 6–7)	MILES (000) 3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60
			KILOMETERS (000) 5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
1	Engine Oil and Oil Filter Change*	Every 3 000 Miles (5 000 km) or 3 Months	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
2	Chassis Lubrication	Every Other Oil Change		●		●		●		●		●		●		●		●		●		●
3	Tire and Wheel Inspection and Rotation	Every 6 000 Miles (10 000 km)		●		●		●		●		●		●		●		●		●		●
4	Water Pump Belt Inspection*	Every 30 000 Miles (50 000 km) or 30 Months										●										●
5	Cooling System Service*	See Explanation of Scheduled Maintenance Services																				
6	Brake Fluid Inspection	Every 15 000 Miles (25 000 km) or 15 Months					●					●					●					●
7	Transaxle Service	See Explanation of Scheduled Maintenance Services																				
8	Spark Plug Replacement*	Every 30 000 Miles (50 000 km)										●										●
9	Spark Plug Wires, Replacement*	Every 60 000 Miles (100 000 km) or 60 Months																				●
10	Air Cleaner Element Replacement*	Every 30 000 Miles (50 000 km) or 30 Months										●										●
11	Fuel Tank, Cap and Lines—Inspection*‡	Every 15 000 Miles (25 000 km) or 15 Months					●					●					●					●

** An Emission Control Service.*

‡The U.S. Environmental Protection Agency has determined that the failure to perform this maintenance item will not nullify the emission warranty or limit recall liability prior to the completion of vehicle useful life. General Motors, however, urges that all recommended maintenance services be performed at the indicated intervals and the maintenance be recorded in the Maintenance Schedule Booklet.

K10001-0B-m

Fig. 1 Maintenance Schedule I

SCHEDULED MAINTENANCE SERVICES
SCHEDULE II

Follow Schedule II only if none of the driving conditions specified in Schedule I apply.

	TO BE SERVICED	WHEN TO PERFORM Miles (kilometers) or Months, Whichever Occurs First (Also, See Explanation of Services Pages 6–7)	The services shown in this schedule up to 60 000 miles (100 000 km) are to be performed after 60 000 miles at the same intervals. MILES (000)							
			7.5	15	22.5	30	37.5	45	52.5	60
			KILOMETERS (000)							
			12.5	25	37.5	50	62.5	75	87.5	100
1	Engine Oil and Oil Filter Change*	Every 7 500 Miles (12 500 km) or 7.5 Months	●	●	●	●	●	●	●	●
2	Chassis Lubrication	Every 7 500 Miles (12 500 km) or 7.5 Months	●	●	●	●	●	●	●	●
3	Tire and Wheel Inspection and Rotation	At 7 500 Miles (12 500 km) and Then Every 15 000 Miles (25 000 km)	●		●		●		●	
4	Water Pump Belt Inspection*	Every 30 000 Miles (50 000 km) or 30 Months				●				●
5	Cooling System Service*	See Explanation of Scheduled Maintenance Services		●		●		●		●
6	Brake Fluid Inspection	Every 15 000 Miles (25 000 km) or 15 Months		●		●		●		●
7	Transaxle Service	See Explanation of Scheduled Maintenance Services								
8	Spark Plug Replacement*	Every 30 000 Miles (50 000 km)				●				●
9	Spark Plug Wires, Replacement*	Every 60 000 Miles (100 000 km) or 60 Months								●
10	Air Cleaner Element Replacement*	Every 30 000 Miles (50 000 km) or 30 Months				●				●
11	Fuel Tank, Cap and Lines—Inspection*‡	Every 15 000 Miles (25 000 km) or 15 Months		●		●		●		●

** An Emission Control Service.*

‡The U.S. Environmental Protection Agency has determined that the failure to perform this maintenance item will not nullify the emission warranty or limit recall liability prior to the completion of vehicle useful life. General Motors, however, urges that all recommended maintenance services be performed at the indicated intervals and the maintenance be recorded in the Maintenance Schedule Booklet.

Fig. 2 Maintenance Schedule II

K10002-0B-m

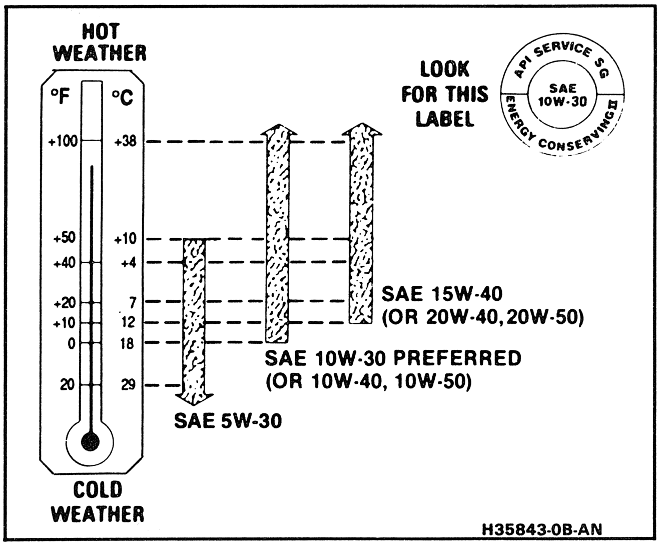

Fig. 3 Engine Oil Viscosity Recommendation – 1.0L

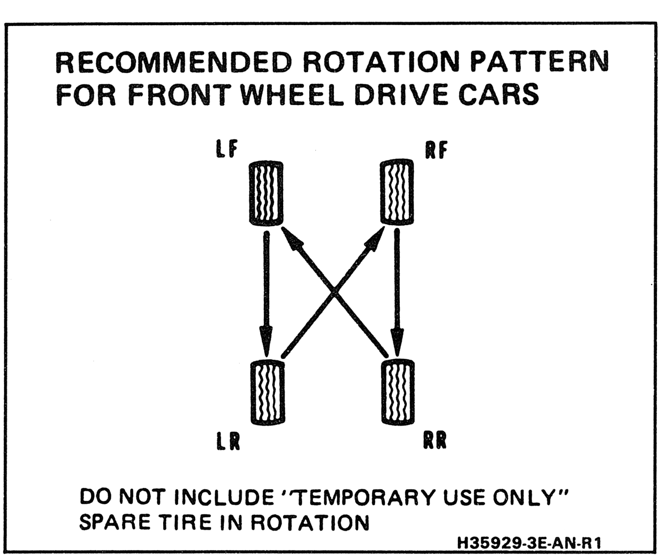
RECOMMENDED ROTATION PATTERN FOR FRONT WHEEL DRIVE CARS
LF
RF
LR
RR
DO NOT INCLUDE "TEMPORARY USE ONLY" SPARE TIRE IN ROTATION
H35929-3E-AN-R1

Fig. 4 Tire Rotation, Front-Wheel-Drive Cars

Cooling System Service

Inspect the cooling system every 15,000 miles (25 000 km).

Drain, flush and refill system with new coolant every 30,000 miles (50 000 km) or 24 months. See Recommended Fluids and Lubricants, or Section 6B.

Transaxle Service

Manual Transaxle Fluid

Check the gear oil level in the manual transaxle every time the engine oil is changed. Before checking gear oil level, check the transaxle case for leaks. If leak is found, repair it. Replace the gear oil every 12,000 miles (20 000 km) or every 12 months under severe conditions.

Automatic Transaxle Fluid

Inspect automatic transaxle fluid every time the oil is changed. Replace oil inlet hose every 45 months or 45,000 miles (75 000 km). Change fluid every 15,000 miles (25 000 km) for Schedule I conditions or every 100,000 miles (160 000 km) for Schedule II conditions.

Spark Plug Replacement

Replace spark plugs every 30,000 miles (50 000 km). See "Maintenance Items" in this section.

Spark Plug Wire Inspection

Clean wires and inspect for burns, cracks or other damage. Also check distributor cap and rotor for cracks, and their electric terminals for wear and corrosion. Replace the parts as necessary. Check the wire boot fit at the distributor and/or coil, and at the spark plugs. Replace the wires as needed.

Positive Crankcase Ventilation (PCV) Inspection

Inspect valve for proper function. Replace valve if necessary. Also, replace any worn, plugged or collapsed hoses.

EGR System Service

1.0L (VIN 6) – Perform EGR System check. See Section 6E2 or 6E3, Chart C7.

Air Cleaner and PCV Filter Replacement

Replace the air cleaner filter every 30,000 miles (50 000 km). Replace more often under dusty conditions.

Replace the crankcase vent filter if so equipped.

Engine Timing Check

Engines with distributors only

Adjust timing to underhood label specifications.

Fuel Tank, Cap and Lines Inspection

Inspect fuel tank, cap and lines for damage or leaks. Inspect fuel rails and injection assemblies, if so equipped. Inspect fuel cap gasket for an even filler neck imprint or any damage. Replace parts as needed.

Thermostatically Controlled Air Cleaner

If equipped

Inspect all hoses and ducts for proper hook-up. Make sure valve works properly.

OWNER INSPECTION AND SERVICES

Listed below are vehicle inspections and services which should be made at the frequencies indicated by either the owner or a qualified technician to help ensure proper safety, emission performance and dependability of the vehicle. Whenever repairs are necessary, have them completed at once.

Any safety related or emissions related components that could have been damaged in an accident should be inspected and all needed repairs should be performed before operating the vehicle.

WHILE OPERATING THE CAR

Automatic transaxle shift indicator operation – Make sure the indicator points to the gear chosen.

Horn operation – Blow the horn occasionally to make sure it works. Check all button locations.

Brake system operation – Be alert to abnormal sounds, increased brake pedal travel or repeated pulling to one side when braking. Also, if the brake warning light goes on, or flashes, something may be wrong with part of the brake system.

Exhaust system operation – Be alert to any changes in the sound of the system or any smell of fumes. These are signs the system may be leaking or overheating. Have it inspected and repaired at once.

Tires, wheels and alignment operation – Be alert to a vibration of the steering wheel or seat at normal highway speeds. This may mean a wheel balance is needed. Also, a pull right or left on a straight level road may show the need for a tire pressure adjustment or a wheel alignment.

Steering system operation – Be alert to changes in steering action. An inspection is needed when the steering wheel is harder to turn, or has too much free play, or if unusual sounds are noted when turning or parking.

Headlight aim – Take note of light pattern occasionally. If beams seem improperly aimed, headlights should be adjusted.

AT EACH FUEL FILL

A fluid loss in any system (except windshield washer) may indicate a problem. Have it inspected and repaired at once.

Engine oil level – Check level and add if necessary. The best time to check the engine oil level is when the oil is warm and when the vehicle is on a level surface. After stopping the engine, wait a few minutes for the oil to drain back to the oil pan. Then, pull out the oil level indicator (dipstick). Wipe it clean, then push the oil level indicator back down all the way. Then pull out the oil level indicator and look at the oil level on it.

Add oil, if needed, to keep the oil level above the "ADD" line and within the area labeled "Operating Range". Avoid overfilling the engine since this may cause engine damage. Push the indicator back down all the way after taking the reading.

If you check the oil level when the oil is cold, do not run the engine first. The cold oil will not drain back to the pan fast enough to give a true oil level.

Engine coolant level and condition – Check level in coolant reservoir tank and add if necessary. Inspect coolant and replace if dirty or rusty.

Windshield washer fluid level – Check level in reservoir and add if necessary.

AT LEAST MONTHLY

Tire and wheel inspection and pressure check – Check tires for abnormal wear or damage. Also check for damaged wheels. Check wheel nuts for proper torque. Pressure should be checked when tires are "cold" (include spare unless it is a stowaway). Maintain pressures as shown in "Tire Pressure Specifications" that are in this section or the Tire Placard which is on the driver's door or door lock pillar.

Light operation – Check operation of license plate light, sidemarker lights, headlights, including high beams, parking lights, taillights, brake lights, (including the center high mounted stop lamp) turn signals, backup lights, instrument panel and interior lights and hazard warning flasher.

Fluid leak check – Periodically, after the car has been parked for a while, inspect the surface beneath the car for water, oil, fuel or other fluids. Water dripping from the air conditioning system after use is normal. If you notice fuel leaks or fumes, the cause should be found and corrected at once.

AT LEAST TWICE A YEAR

Power steering system reservoir level – Check and keep at proper level as described in Section 3B1.

Brake master cylinder reservoir level – Check fluid as described in Section 5 and keep at proper level. A low fluid level can indicate worn disc brake pads which may need to be serviced.

Clutch Release Arm Play – Adjust linkage whenever there is little or no play. Check the play every 7,500 miles (12 500 km) or less. The clutch play should be checked at the clutch release arm on the transaxle (not at the clutch pedal).

Weatherstrip lubrication – Apply Part No. 1052863 or equivalent silicone grease. Apply a thin film using a clean cloth.

EACH TIME OIL IS CHANGED

Automatic transaxle fluid level – Maintain level within operating range on the oil level indicator. See Section 7A.

Manual transaxle – Check fluid level and add as required. See Section 7B.

Brake systems inspection – For convenience, the following should be done when wheels are removed for rotation: Inspect lines and hoses for proper hookup, binding, leaks, cracks, chafing, etc. Inspect disc brake pads for wear and rotors for surface condition. Also inspect drum brake linings for wear and cracks. Inspect other brake parts, including drums, wheel cylinders, parking brake, etc., at the same time. Check parking brake adjustment.

Inspect brakes more often if habit or conditions result in frequent braking.

Steering, suspension and front drive axle boot and seal inspection – Inspect front and rear suspension and steering system for damaged, loose or missing parts, signs of wear or lack of lubrication. Inspect power steering lines and hoses for proper hookup, binding, leads, cracks chafing, etc.

Clean then inspect drive axle boot seals for damage, tears or leakage and replace seals if necessary.

On cars equipped with manual steering gear, check for seal leakage.

Exhaust system inspection – Inspect complete system including catalytic converter. Inspect body near the exhaust system. Look for broken, damaged, missing or out-of-position parts as well as open seams, holes, loose connections or other conditions which could cause a heat build up in the floor pan or could let exhaust fumes seep into the trunk or passenger compartment.

Throttle linkage inspection – Inspect for interference or binding, damaged or missing parts.

Engine drive belts – Inspect all belts for cracks, fraying, wear and proper tension. Adjust or replace as needed.

Hood latch operation – When opening hood, note the operation of secondary latch. It should keep hood from opening all the way when primary latch is released. Make sure that hood closes firmly.

AT LEAST ANNUALLY

Lap and shoulder belts condition and operation – Inspect belt system, including: webbing, buckles, latch plates, retractors, guide loops and anchors.

Movable head restraint operation – On cars with movable restraints, make sure restraints stay in the desired position.

Seatback latch operation – Be sure seatbacks latch on those cars with folding seats using mechanical latches. Make sure the recliner is holding by pushing and pulling on the top of the seatback while it is reclined.

Spare tire and jack storage – Be alert to rattles in rear of car. Make sure the spare tire, all jacking equipment, any tire inflator and any covers or doors are securely stowed at all times. Oil jack ratchet or screw mechanism after each use.

Key lock service – Lubricate key lock cylinder.

Body lubrication service – Lubricate all body door hinges, including the hood, fuel door and rear compartment hinges and latches, the glove and console doors, and any folding seat hardware.

Also lubricate the hood and door hinges, hatchback lid hinge and linkage.

Starter Safety Switch Operation –

CAUTION: Before performing the following starter safety switch check, be sure to have enough room around the car. Then, firmly apply both the parking brake and the regular brakes. Do not use the accelerator pedal. If the engine starts, be ready to turn off the ignition promptly. Take these precautions because the car could move without warning and possibly cause personal injury or property damage.

On automatic transaxle cars, try to start the engine in each gear. The starter should crank only in "P" (Park) or "N" (Neutral).

On manual transaxle cars, place the shift lever in "Neutral", push the clutch halfway and try to start. The starter should crank only when the clutch is fully depressed.

Steering column lock operation – While parked, try to turn key to "Lock" in each gear range. The key should turn to "Lock" only when the gear selector is in "Park" on automatic or "Reverse" on manual transaxles.

On all vehicles, the key should come out only in "Lock".

CAUTION: Do not remove the ignition key when the vehicle is moving. This will lock the steering column and result in loss of ability to steer the vehicle.

Parking brake and transaxle "Park" mechanism operation –

CAUTION: Before checking the holding ability of the parking brake and automatic transaxle "PARK" mechanism, park on a fairly steep hill with enough room for movement in the downhill direction. To reduce the risk of personal injury or property damage, be prepared to apply the regular brakes promptly if the car begins to move.

To check the parking brake, with the engine running and transaxle in "Neutral", slowly remove foot pressure from the regular brake pedal (until the car is held by only the parking brake).

To check the automatic transaxle "Park" mechanism holding ability, release all brakes after shifting the transaxle to "P" (Park).

Underbody flushing – At least every spring, flush from the underbody with plain water, any corrosive materials used for ice and snow removal and dust control. Take care to thoroughly clean any areas where mud and other debris can collect. Sediment packed in closed areas of the vehicle should be loosened before being flushed.

Engine cooling system – Inspect coolant and freeze protection. If dirty or rusty, drain, flush and refill with new coolant. Keep coolant at the proper mixture for proper freeze protection, corrosion inhibitor level and best engine operating temperature. Inspect hoses and replace if cracked, swollen or deteriorated. Tighten hose clamps. Clean outside of radiator and air conditioning condenser. Wash radiator filler cap and neck. To help ensure proper operation, a pressure test of both the cooling system and cap is also recommended.

RECOMMENDED FLUIDS AND LUBRICANTS

Engine oil – GM Goodwrench motor oil or equivalent for API service SG Energy Conserving II of recommended viscosity.

Engine coolant – Mixture of water and good quality ethylene glycol base antifreeze conforming to GM Specification 1825M (GM Part No. 1052753).

Brake system – Delco Supreme 11 Brake Fluid (GM Part No. 1052535) or equivalent DOT-3 brake fluid.

Parking brake cable guides, underbody contact points and linkage – Chassis grease meeting requirements of GM Specification 6031M (GM Part No. 1052497).

Automatic transaxle – DEXRON® II Automatic transmission fluid (GM Part No. 1051855).

Manual transaxle – Synchromesh transmission fluid SAE 75W (GL-50) (GM Part No. 12345349).

Automatic transaxle shift linkage – Chassis grease meeting requirements of GM Specification 6031M (GM Part No. 1052497).

Manual transaxle shift linkage – Chassis grease meeting requirements of GM Specification 6031M (GM Part No. 1052497).

Clutch linkage pivot points – Chassis grease meeting requirements of GM Specification 6031M (GM Part No. 1052497).

Key lock cylinders – Lubricate with Multi-Purpose Lubricant (GM Part No. 12345120) or synthetic SAE 5W30 engine oil. (Do not use aerosols)

Chassis lubrication, Parking Brake Cables, and Wheel Bearings – Chassis grease meeting requirement of GM Specification 6031M (GM Part No. 1052497).

Hood and door hinges, or hatchback lid hinge and linkage, Rear folding seat, Fuel door hinge and Rear compartment lid hinges – Engine oil.

Windshield washer solvent – GM Optikleen washer solvent Part No. 1051515 or equivalent.

Weatherstrips – Silicone grease (GM Part No. 1052863 or equivalent).

MAINTENANCE ITEMS –

Air Cleaner Element	
1.0L (VIN 6)	AC Type A893C
Engine Oil Filter	
1.0L (VIN 6)	AC Type PF53
PCV Valve	
1.0L (VIN 6)	Part No. 96051849
Spark Plugs	
1.0L (VIN 6)	AC Type R43CXLS, NGK:BPR6ES-11, or ND:W16ER-U11
1.0L (VIN 2)	AC Type R43CXLS, NGK:BPR6ES-11, or ND:W20EXR-U11

APPROXIMATE FLUID CAPACITIES –

Engine Crankcase	3.7 Quarts (3.5 Liters)
When changing the oil filter, additional oil may be needed	
Fuel Tank	10 Gallons (40 Liters)
Transaxle	
Automatic – Drain and Refill	5.2 Quarts (4.9 Liters)
Manual – 5 Speed	2.5 Quarts (2.4 Liters)
● After refill, check oil levels.	
Engine Cooling System	
1.0L (VIN 6)	4.2 Quarts (4.0 Liters)

TIRE PRESSURE SPECIFICATIONS

All Tire Sizes, Except Compact Spare	29 PSI (200 kPa)
Compact Spare	60 PSI (415 kPa)

SECTION 1A

HEATER AND VENTILATION

CONTENTS

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GENERAL DESCRIPTION

BODY VENTILATION

The base heater system is designed to provide heating, ventilation, windshield defrosting, and side window defogging. The ventilation system of this vehicle consists of a fresh air intake located at the cowl panel. Air is drawn into the vehicle through the blower case and is drawn out through ventilator outlets located near the bottom of each rear quarter panel.

HEATING SYSTEM

The power-vent, heat, and defrost provisions of the base system are controlled within the heater and blower case assemblies. Both of these assemblies are mounted to the rear of the bulkhead, and the blower inlet is mounted to the rear of the cowl (Figure 1).

HEATING SYSTEM CONTROL AND AIR DISTRIBUTION

All heating system operations are actuated through the heater control assembly. There are four control levers used to operate the heating system. They are as follows (Figure 2):

- Lever A - Mode control lever: Determines output airflow into the vehicle interior.
- Lever B - Fresh/recirculate control lever: Used to control the amount of fresh and/or recirculated air admitted into the heating system.
- Lever C - Temperature control lever: Used to control the amount of airflow through and/or around the heater core.
- Lever D - Blower speed control lever (Blower switch): A five position, four speed switch used to control the amount of output airflow into the vehicle interior.

Also illustrated is the actuation of the various control doors (dampers), effecting air distribution during all heater system modes of operation (Figure 2).

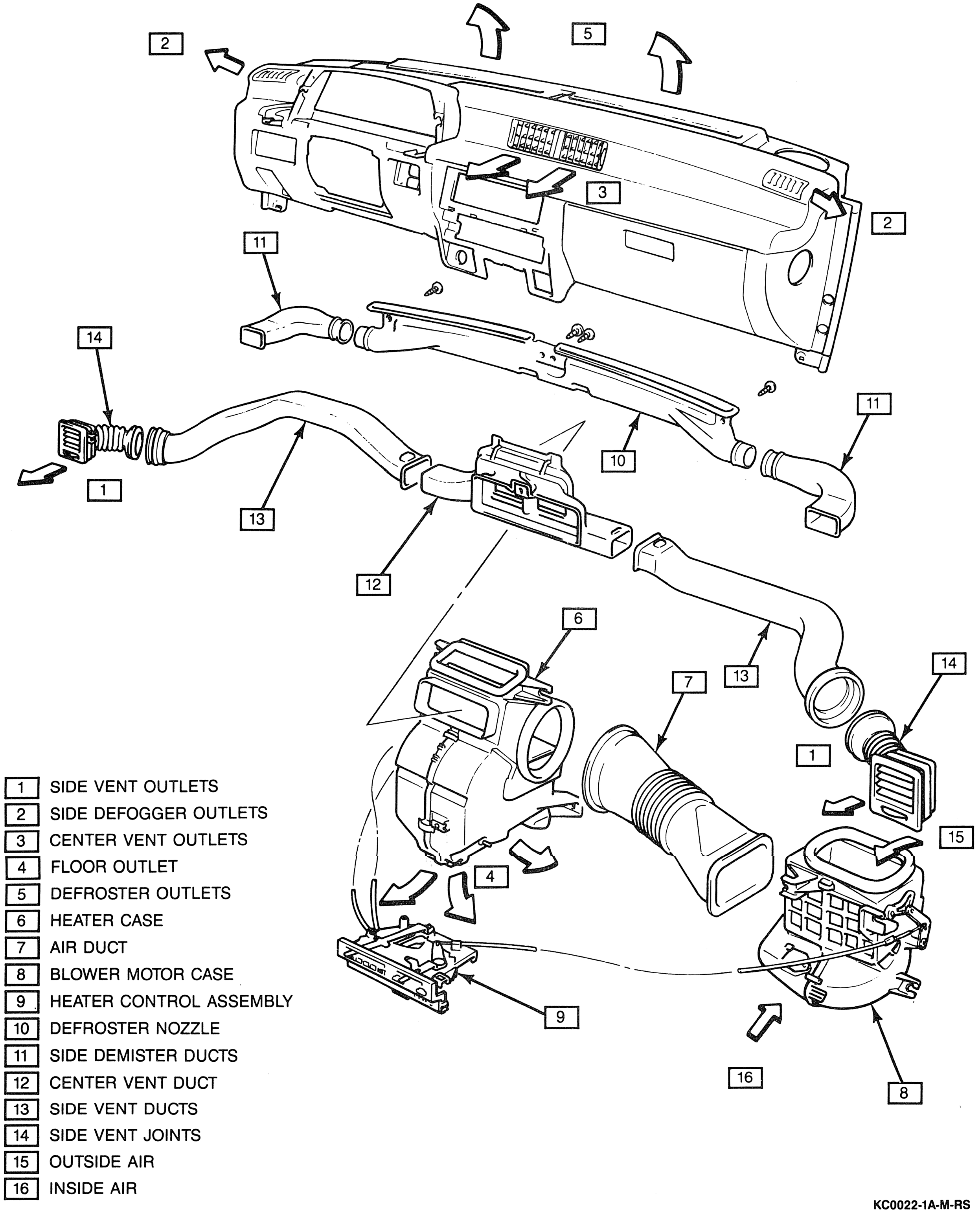
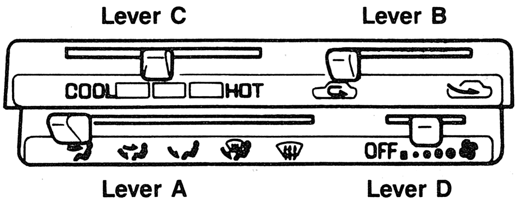

2
5
3
2
11
14
11
10
1
13
12
6
7
13
14
1
15
4
9
16
8
1 SIDE VENT OUTLETS
2 SIDE DEFOGGER OUTLETS
3 CENTER VENT OUTLETS
4 FLOOR OUTLET
5 DEFROSTER OUTLETS
6 HEATER CASE
7 AIR DUCT
8 BLOWER MOTOR CASE
9 HEATER CONTROL ASSEMBLY
10 DEFROSTER NOZZLE
11 SIDE DEMISTER DUCTS
12 CENTER VENT DUCT
13 SIDE VENT DUCTS
14 SIDE VENT JOINTS
15 OUTSIDE AIR
16 INSIDE AIR
KC0022-1A-M-RS

Figure 1 Heater System


Lever C
Lever B
COOL
HOT
OFF
Lever A
Lever D

Lever A
Mode Control lever.

	VENTILATION	Air flows from center and side outlets	A-1
	BI-LEVEL	Air flows from center, side and floor outlets	A-2
	HEAT	Air flows from floor outlet	A-3
	HEAT/ DEFROSTER	Air flows from floor outlet, front defroster and side defogger outlets	A-4
	DEFROSTER	Air flows from front defroster and side defogger outlets	A-5

Lever B
Fresh/Recirc control lever.

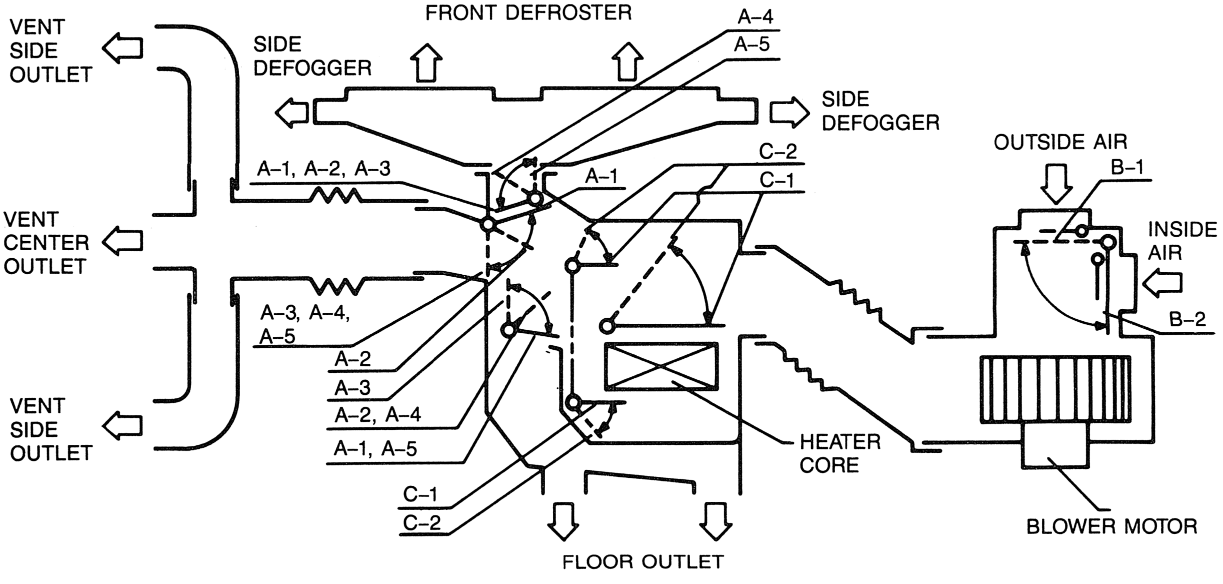
	CIRCULATION	B-1
	FRESH AIR	B-2

Lever C
Temperature control lever.

COOL	C-1
HOT	C-2

Lever D
Blower speed control lever (Blower Switch).

	D


VENT SIDE OUTLET
SIDE DEFOGGER
FRONT DEFROSTER
A-4
A-5
SIDE DEFOGGER
OUTSIDE AIR
B-1
INSIDE AIR
B-2
A-1, A-2, A-3
A-1
C-2
C-1
VENT CENTER OUTLET
A-3, A-4, A-5
A-2
A-3
A-2, A-4
A-1, A-5
VENT SIDE OUTLET
HEATER CORE
C-1
C-2
FLOOR OUTLET
BLOWER MOTOR

LC0001-1A-M-RS

Figure 2 Heater Control Operation and Air Distribution

DIAGNOSIS

BLOWER INOPERATIVE

CONDITION	POSSIBLE CAUSE	CORRECTION
Blower inoperative in all blower switch positions.	Fuse blown.	Check for short, replace fuse.
	Faulty blower resistor.	Inspect blower resistor, replace if necessary (Figure 9).
	Faulty blower motor.	Replace blower motor (Figure 8).
	Faulty wiring or ground.	Repair as necessary.

INSUFFICIENT HEATING

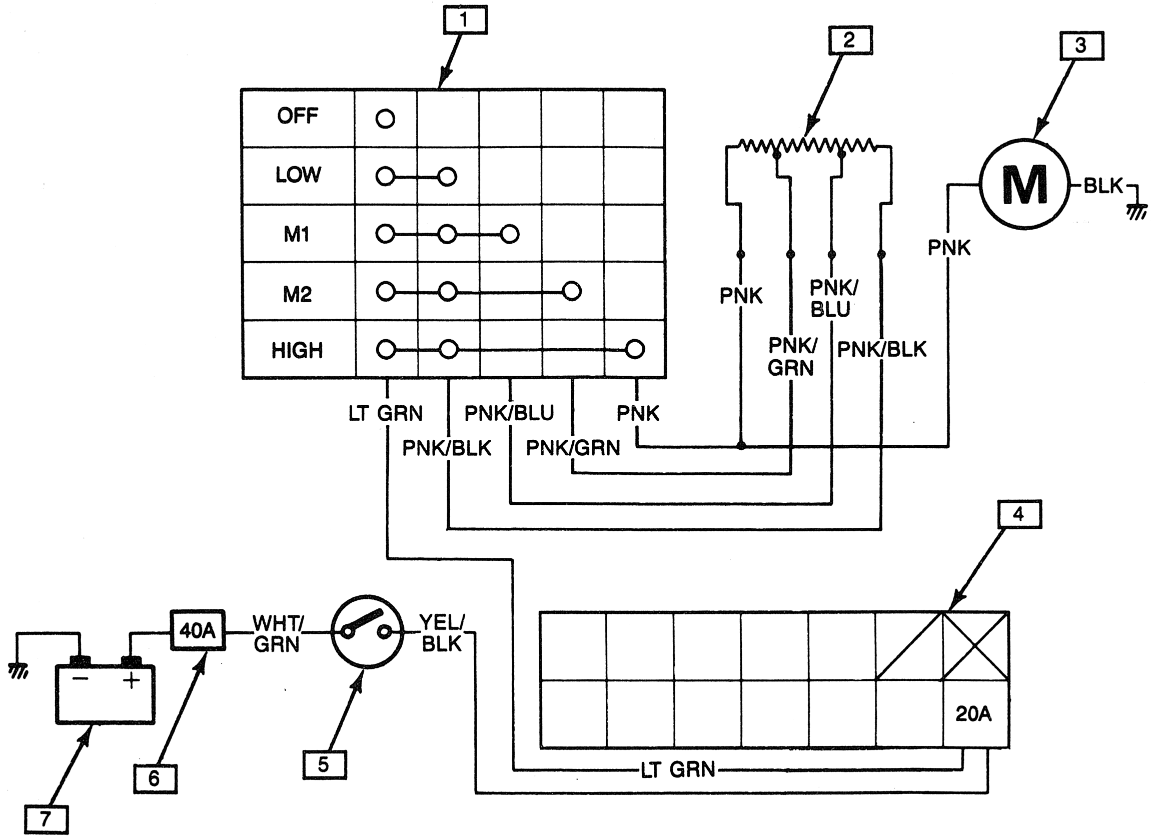
CONDITION	POSSIBLE CAUSE	CORRECTION
Insufficient heating.	Control cables broken or binding.	R&R control cables as necessary.
	Control door (damper) broken or binding.	R&R control door (damper) as necessary.
	Heater ducts restricted or blocked.	R&R heater ducts as necessary.
	Radiator leaking or blocked.	R&R radiator as necessary.
	Heater core leaking or blocked.	R&R Heater core as necessary.
	Heater hoses leaking or blocked.	Replace heater hoses.

BLOWER RESISTOR DIAGNOSIS

Measure terminal-to-terminal resistance of the blower resistor. If measured resistance is not within specification, the blower resistor must be replaced. If necessary, refer to "Blower Resistor Replacement" procedure in this section (Figures 3, 4, and 9).

BLOWER MOTOR SWITCH DIAGNOSIS

Check blower switch for continuity. If opens or shorts are found within the switch, the switch must be replaced. If necessary, refer to "Blower Switch eplacement" procedure in this section (Figures 3 and 5).


1
2
3
OFF
LOW
M1
M2
HIGH
M
BLK
PNK
PNK
PNK/
BLU
PNK/
GRN
PNK/BLK
LT GRN
PNK/BLU
PNK
PNK/BLK
PNK/GRN
4
40A
WHT/
GRN
YEL/
BLK
20A
LT GRN
6
5
7

1 BLOWER MOTOR SWITCH
2 HEATER RESISTOR
3 BLOWER MOTOR
4 FUSE BOX
5 MAIN SWITCH
6 MAIN FUSE
7 BATTERY

WHT/GRN: WHITE/GREEN
LT GRN: LIGHT GREEN
PNK/BLU: PINK/BLUE
PNK: PINK
BLK: BLACK
YEL/BLK: YELLOW/BLACK
PNK/BLK: PINK/BLACK
PNK/GRN: PINK/GREEN

KC0038-1A-M-RS

Figure 3 Blower Motor Wiring Diagram

TERMINAL-TO-TERMINAL	RESISTANCE (Ω)
H — LO	2.5 ± 0.3
H — M1	1.4 ± 0.4
H — M2	0.5 ± 0.3

KC0094-1A-JT-RS

Figure 4 Blower Resistor Resistance Specification Chart

	LT GRN	PNK/BLK	PNK/BLU	PNK/GRN	PNK
LOW	○	○			
M1	○	○	○		
M2	○	○		○	
HIGH	○	○			○

LT GRN: LIGHT GREEN
PNK/BLK: PINK/BLACK
PNK/BLU: PINK/BLUE
PNK/GRN: PINK/GREEN
PNK: PINK

KC0039-1A-M-RS

Figure 5 Blower Switch Continuity Checks

ON-VEHICLE SERVICE

HEATER BLOWER MOTOR

Figures 6, 7, and 8

↔ Remove or Disconnect

1. Negative battery cable.
2. Two attaching screws from glove box striker and remove striker (See Body and Chassis Electrical section 8).
3. One attaching screw from rear of glove box upper panel and remove panel. See BODY AND CHASSIS ELECTRICAL (Section 8).
4. Blower motor and blower resistor electrical connectors.
5. Fresh/recirculate control cable from blower case assembly.
6. Three blower case mounting bolts and case from vehicle (Figure 7).
7. Air hose from the blower case.
8. Three mounting screws from the blower motor and motor from blower case (Figure 8).
9. Blower fan attaching nut and fan from blower motor shaft (Figure 6).

→← Install or Connect

1. Blower fan to blower motor and fan attaching nut to blower motor shaft.
2. Blower motor to blower case and three mounting screws to blower motor.

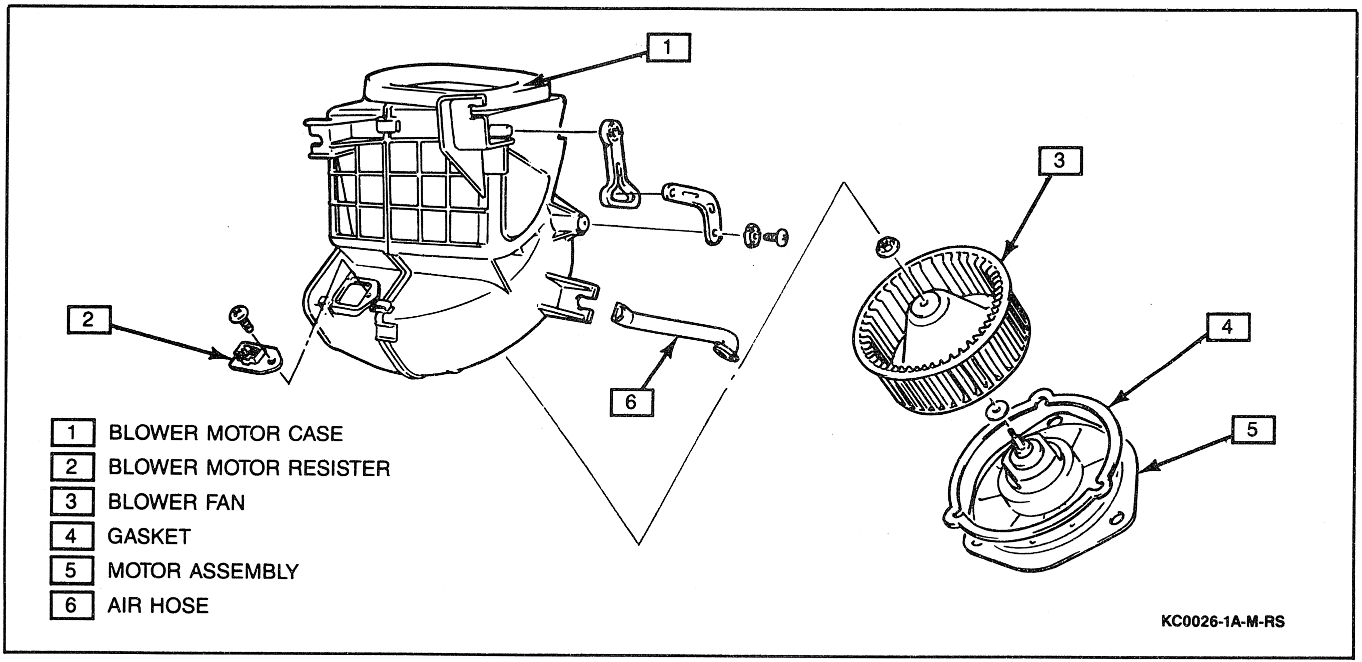


Figure 6 Heater Blower Motor Assembly

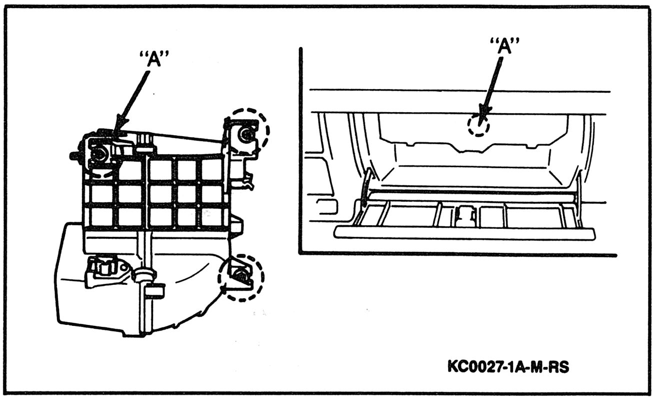


Figure 7 Blower Case Removal

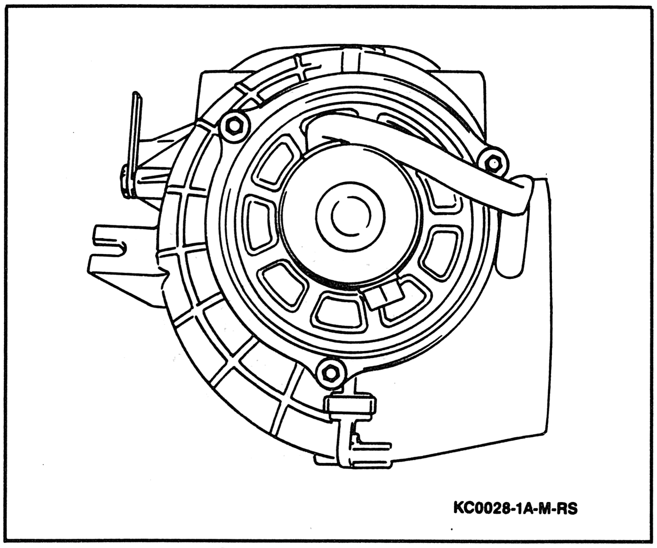


Figure 8 Blower Motor Removal

3. Air hose to blower case.
4. Blower case to vehicle and three mounting bolts to blower case.
5. Fresh/recirculate control cable to blower case assembly.

NOTICE: Adjust fresh/recirculate cable. See "Adjust" procedure in this section.

6. Blower motor and blower resistor electrical connectors.
7. Glove box upper panel to instrument panel carrier assembly and one attaching screw to rear of panel (See section 8).
8. Glove box striker to glove box upper panel and two attaching screws to glove box striker. See BODY AND CHASSIS ELECTRICAL (Section 8).
9. Negative battery cable.

HEATER BLOWER MOTOR RESISTOR

Figures 6 and 9

Remove or Disconnect

1. Heater blower case. See "Heater Case" procedure in this section.
2. One attaching screw and blower resistor from blower case (Figures 6 and 9).

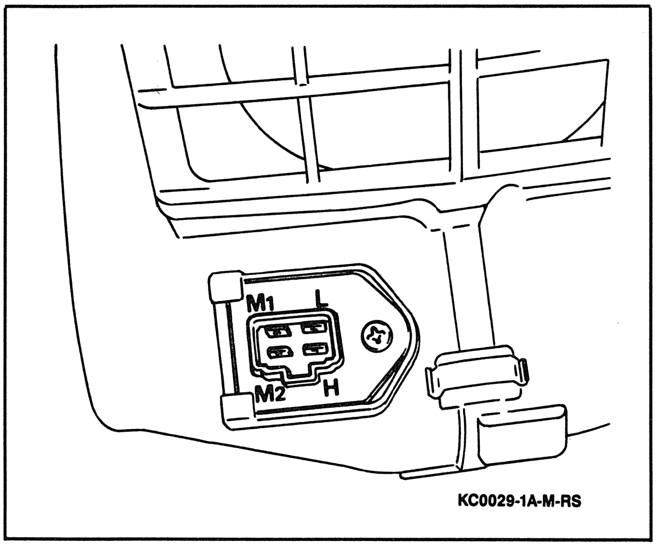


Figure 9 Heater Blower Motor Resistor

Install or Connect

1. Blower resistor to blower case and one attaching screw to blower resistor (Figures 6 and 9).
2. Heater blower case. See "Heater Case" procedure in this section.

BLOWER SWITCH

Remove or Disconnect

1. Negative battery cable.
2. Ashtray assembly and ashtray upper plate by removing two upper plate attaching screws.
3. Cigar lighter assembly from instrument panel bezel.
4. A/C switch. See AIR CONDITIONING (Section 1B).
5. All heater control knobs.
6. Radio from vehicle. See BODY AND CHASSIS ELECTRICAL (Section 8).
7. Two instrument panel bezel attaching screws and bezel from instrument panel carrier.
8. Two mounting screws from heater control panel and remove panel.
9. Blower switch electrical connector.
10. Three control cables from the heater control assembly and assembly from instrument panel support member.

NOTICE: The blower motor switch cannot be removed from the heater control assembly. If the switch is found to be faulty, the heater control assembly must be replaced.

Install or Connect

1. Heater control assembly to instrument panel support member and three control cables to heater control assembly.

NOTICE; Adjust control cables. See "Adjust" procedure in this section.

2. Blower switch electrical connector.
3. Heater control panel to instrument panel carrier assembly and two mounting screws to panel.
4. Instrument panel bezel to instrument panel carrier assembly and two attaching screws to bezel.
5. Radio to vehicle. See "Body and Chassis Electrical" procedure in this section.
6. All heater control knobs.
7. A/C switch. See AIR CONDITIONING (Section 1B).
8. Cigar lighter assembly to instrument panel bezel.
9. Ashtray upper plate to instrument panel carrier assembly and two attaching screws to plate.
10. Ashtray assembly to ashtray upper plate.
11. Negative battery cable.

HEATER CONTROL CABLES

Figures 10 and 11

Remove or Disconnect

1. Heater control assembly from instrument panel support member. See "Blower Switch" procedure in this section.
2. Three control cables from heater control assembly (Figure 10).
3. Mode and temperature control cables from heater case and cables from vehicle (Figure 10).

NOTICE: Note cable routing for ease of cable installation.

4. Fresh/recirculate control cable from blower motor case and remove cable from vehicle (Figure 10).

NOTICE: Note cable routing for ease of cable installation.

Install or Connect

1. Fresh/recirculate control cable to vehicle, route cable as previously noted (Figure 10).
2. Mode and temperature control cables to vehicle, route cables as previously noted (Figure 10).
3. Three control cables to heater control assembly (Figure 10).
4. Heater control assembly to instrument panel support member. See "Blower Switch" procedure in this section.

Adjust

1. After installation of control cables to the heater control assembly, perform the following:
   - Set temperature control lever to the HOT position.
   - Set mode control lever to the DEFROSTER position.
   - Set the fresh/recirc control lever to the FRESH position.
2. Connect and clamp each respective control cable to the heater and blower case with heater control assembly set as previously described (Figure 11).

NOTICE: After completion of control cable adjustment, be sure that control levers move smoothly and stop at proper positions.

HEATER CASE

Figures 12, 13, and 14

Remove or Disconnect

1. Negative battery cable.
2. Drain engine cooling system. See ENGINE COOLING (Section 6B).
3. Clamps and heater core hoses from heater core. See ENGINE COOLING (Section 6B).
4. Instrument panel carrier assembly. See BODY AND CHASSIS ELECTRICAL (Section 8).
5. Heater control assembly from instrument support member. See "Blower Switch" procedure in this section.
6. Temperature and mode control cables from heater case. See "Blower Switch" procedure in this section.
7. Two mounting bolts and two mounting nuts from heater case (Figure 14).
8. Heater case from vehicle.

Install or Connect

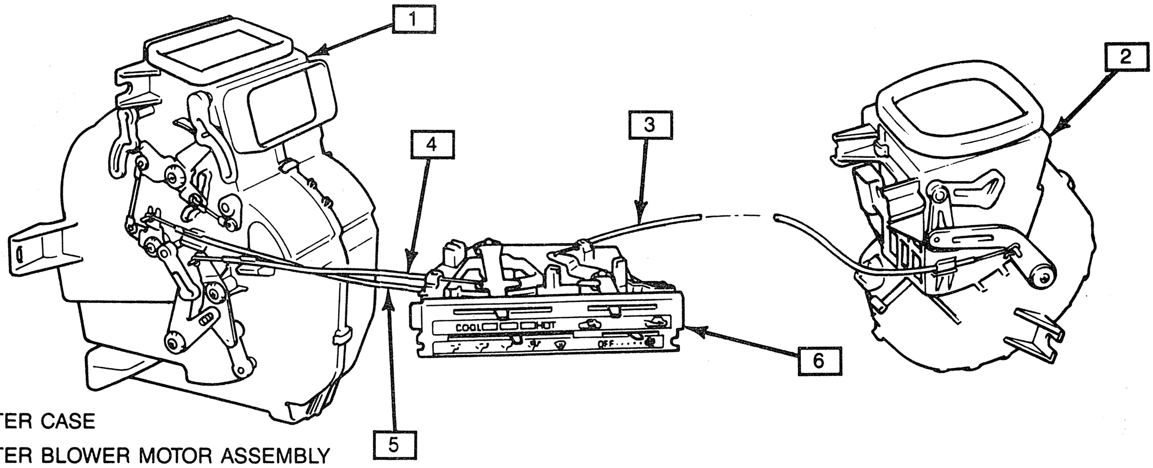
1. Heater case to vehicle.
2. Two mounting bolts and two mounting nuts to heater case.
3. Temperature and mode control cables to heater case. See "Heater Control Cables" procedure in this section.

Adjust

- Control cables. See "Adjust" procedure in this section.

4. Heater control assembly to instrument panel support member. See "Adjust" procedure in this section.
5. Instrument panel carrier assembly. See BODY AND CHASSIS ELECTRICAL (Section 8).
6. Heater core hoses and clamps to heater core.
7. Full engine cooling system.
8. Negative battery cable.

NOTICE: After completion of installation procedure, run engine and check for coolant leaks. Correct as necessary.



1 HEATER CASE
2 HEATER BLOWER MOTOR ASSEMBLY
3 FRESH/RECIRC CONTROL CABLE
4 TEMPERATURE CONTROL CABLE
5 MODE CONTROL CABLE
6 HEATER CONTROL PANEL AND ASSEMBLY

KC0031-1A-M-RS

Figure 10 Control Cables

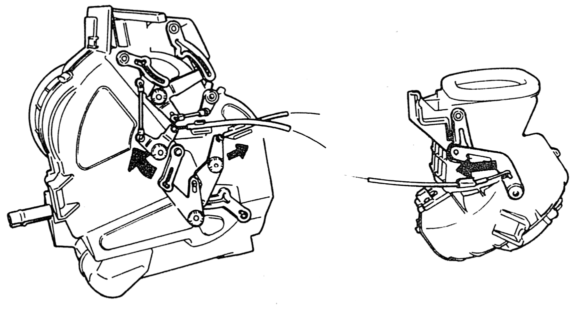


Figure 11 Control Cables Adjustment

HEATER CORE

Figures 15 and 16

←→ Remove or Disconnect

1. Heater case from the vehicle. See "Heater Case" procedure in this section.
2. All heater case retaining clips and two attaching screws from heater case (Figure 15).
3. Separate heater case hafts (Figure 15).
4. Carefully pull heater core from heater case (Figure 16).

→← Install or Connect

1. Heater core to heater case.
2. Heater case halves together.
3. All heater case retaining clips and two attaching screws to heater case.
4. Heater case to the vehicle. See "Heater Case" procedure in this section.

Inspect

- After completion of installation procedure, run engine and check for coolant leaks. Correct as necessary.

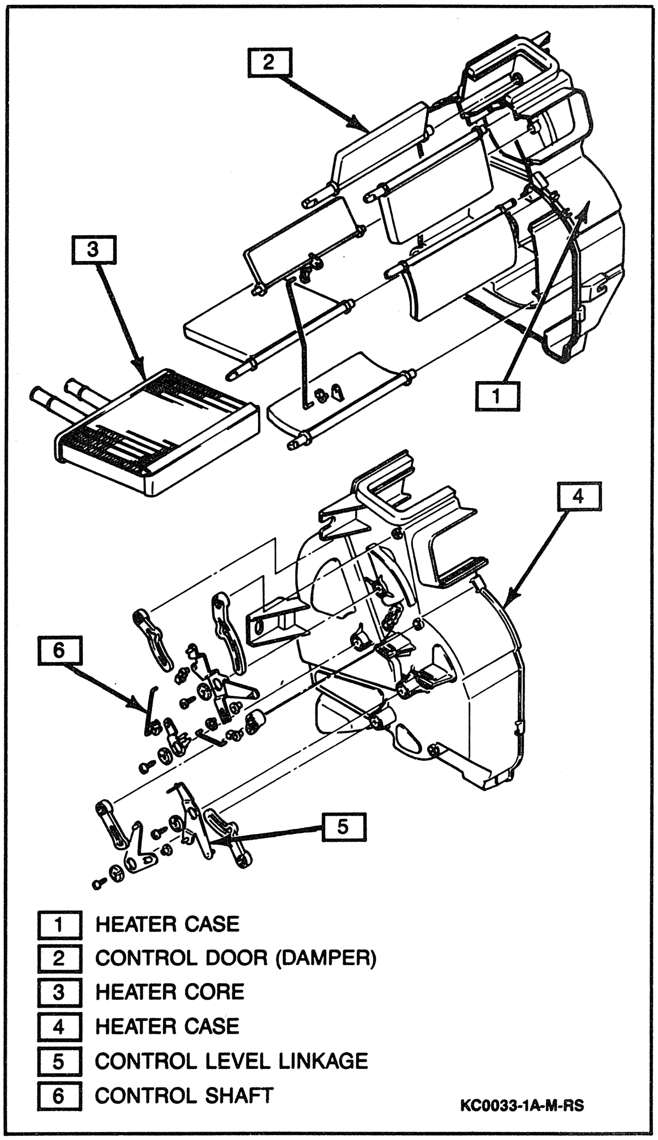

2
3
1
4
6
5
1 HEATER CASE
2 CONTROL DOOR (DAMPER)
3 HEATER CORE
4 HEATER CASE
5 CONTROL LEVEL LINKAGE
6 CONTROL SHAFT
KC0033-1A-M-RS

Figure 12 Heater Case Exploded View

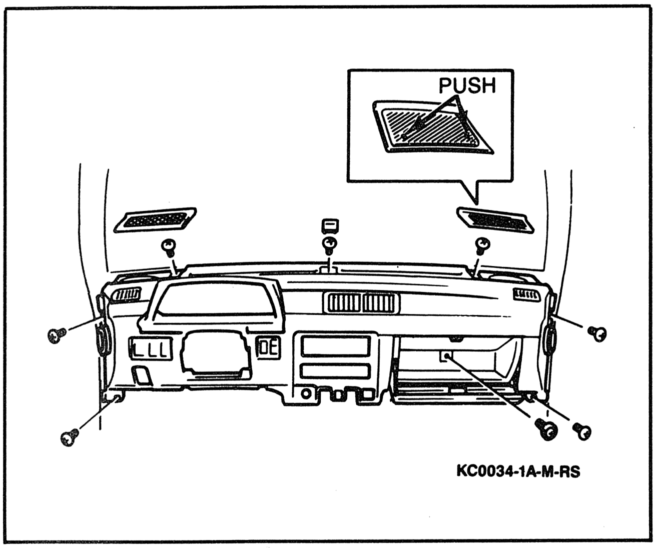

PUSH
KC0034-1A-M-RS

Figure 13 Instrument Panel Carrier Removal

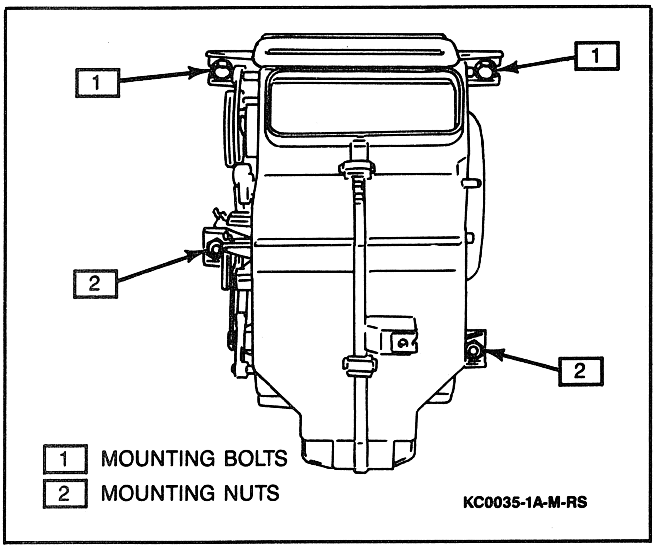

1
1
2
2
1 MOUNTING BOLTS
2 MOUNTING NUTS
KC0035-1A-M-RS

Figure 14 Heater Case Removal

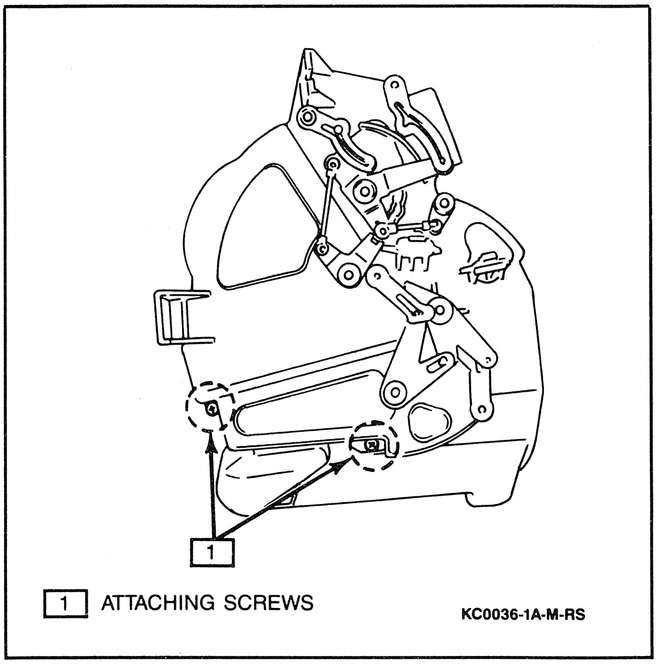

1
1 ATTACHING SCREWS
KC0036-1A-M-RS

Figure 15 Heater Case Disassembly

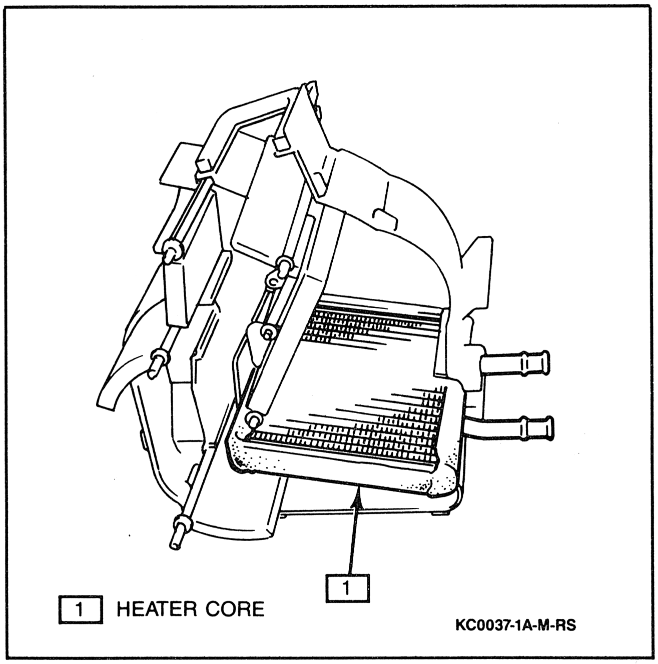

1
1 HEATER CORE
KC0037-1A-M-RS

Figure 16 Heater Core Removal

SECTION 1B

AIR CONDITIONER

CONTENTS

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  Major Components and Refrigerant Flow of Air Conditioning System 1B-2
  Function of Each Control Component 1B-4
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  Air Conditioning Refrigerant Recovery and Recycling (ACR^3) Set Up and Refrigerant Recovery 1B-5
  Evacuating System 1B-9
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  Handling of Refrigerant Lines and Fittings 1B-10
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  Wiring Precautions 1B-15
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  Condenser 1B-16
  Receiver/Dryer 1B-16
  Evaporator 1B-17
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    Evaporator Thermistor 1B-19
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  Vacuum Switching Valve (VSV) 1B-21
  Magnetic Clutch 1B-22
  Condenser Fan and/or Magnetic Clutch Relay 1B-22
  Compressor 1B-22
  Compressor Mount 1B-23
  Compressor Drive Belt 1B-23
Performance Test 1B-23
Special Tools 1B-26

This vehicle can be provided with an optional air conditioner. This Section covers the description, service and charging procedures of the air conditioner.

GENERAL DESCRIPTION

COMPRESSOR

The compressor performs two main functions. It compresses the low pressure refrigerant vapor from the evaporator into a high pressure, high temperature vapor. Also, the compressor pumps refrigerant and refrigerant oil through the A/C system. Complete compressor overhaul procedures can be found in Section 1D of the Service Manual. The compressor used in this vehicle is of the swash plate design.

MAGNETIC CLUTCH

The magnetic clutch engages and disengages the compressor when the air conditioning is on.

CONDENSER

The condenser assembly, mounted to the right of the radiator is made up of coils which carry the refrigerant and cooling fins which provide rapid transfer of heat. The air passing through the condenser cools the high pressure refrigerant vapor causing it to condense into a liquid. Increased cooling is achieved by a condensor cooling fan mounted in front of the condenser assembly.

RECEIVER/DRYER

The receiver/dryer performs the following three functions:

A. The receiver serves as a temporary storage container for condensed-liquid refrigerant so that it is possible to supply the evaporator with the condensed-liquid refrigerant, conforming to the demand of the cooling load.

B. The dryer serves to remove the dirt and water mixed in the cycling refrigerant by means of the filter and desiccant bag.

C. The sight glass, installed atop the receiver serves to show the flowing state of the refrigerant.

PRESSURE SWITCH

The pressure switch is used to stop further rotation of the compressor by turning OFF the electric circuits to the compressor and condenser cooling fan when the cycling refrigerant has abnormally dropped or risen in pressure.

EXPANSION VALVE

The expansion valve is a device used to convert high pressure liquid refrigerant into a low pressure state. As high pressure liquid refrigerant enters the valve from the receiver/dryer and passes through the seat and orifice, it is then expanded and ejected as a low pressure liquid. This low pressure liquid refrigerant then flows to the evaporator core where it becomes a low pressure vapor and leaves the evaporator core as such.

EVAPORATOR

The evaporator is a device which cools and dehumidifies the air before it enters the vehicle. High pressure liquid refrigerant flows through the expansion valve into the low pressure area of the evaporator. The heat in the air passing through the evaporator core is lost to the cooler surface of the core, thereby cooling the air. As the process of heat loss from the air to the evaporator core surface is taking place, any moisture (humidity) in the air condenses on the outside surface of the evaporator core and is drained off as water.

MAJOR COMPONENTS AND REFRIGERANT FLOW OF AIR CONDITIONING SYSTEM

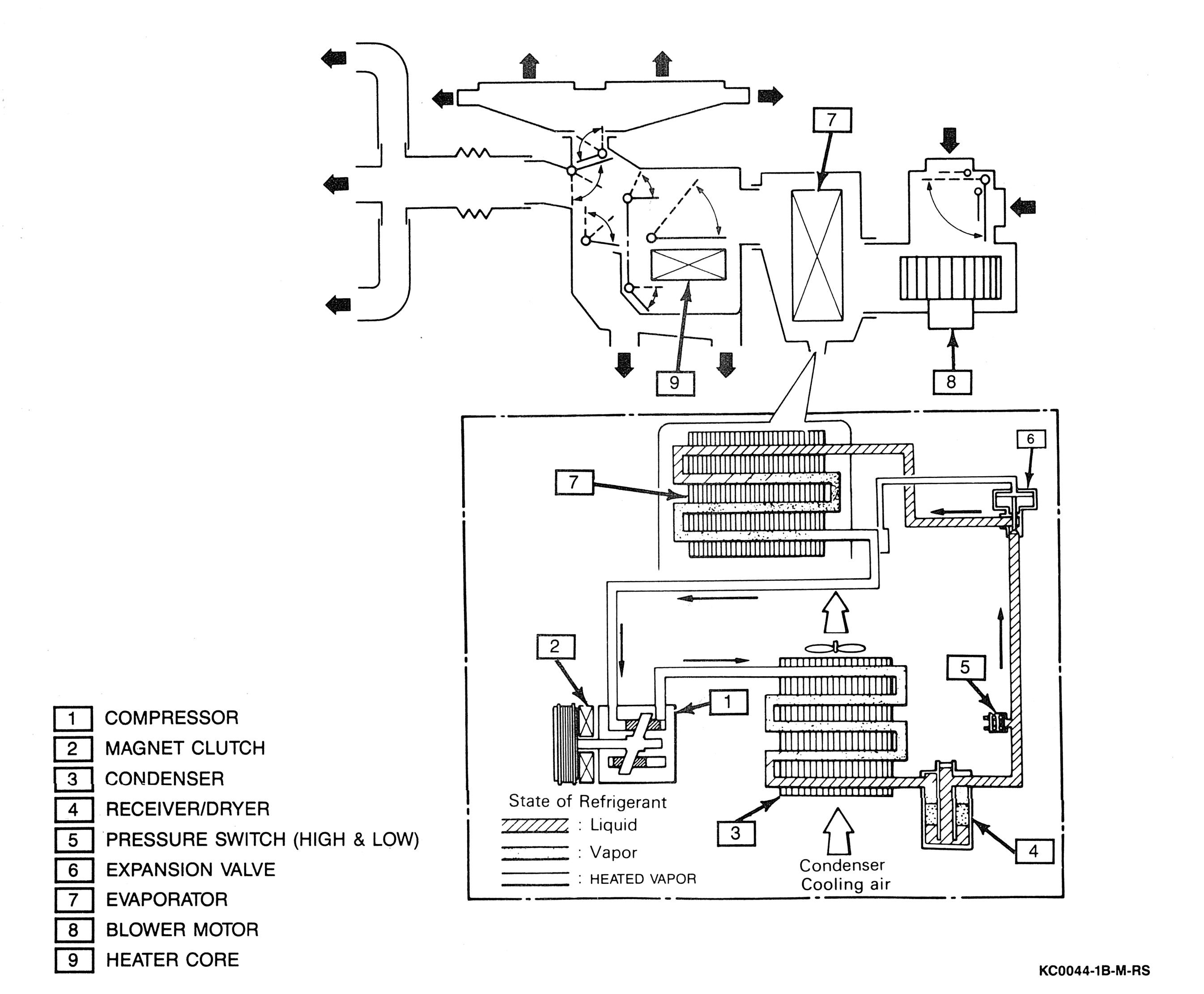

7
9
8
7
6
2
1
5
3
4
State of Refrigerant
: Liquid
: Vapor
: HEATED VAPOR
Condenser
Cooling air
1 COMPRESSOR
2 MAGNET CLUTCH
3 CONDENSER
4 RECEIVER/DRYER
5 PRESSURE SWITCH (HIGH & LOW)
6 EXPANSION VALVE
7 EVAPORATOR
8 BLOWER MOTOR
9 HEATER CORE
KC0044-1B-M-RS

Figure 1 Major Components and Refrigerant Flow

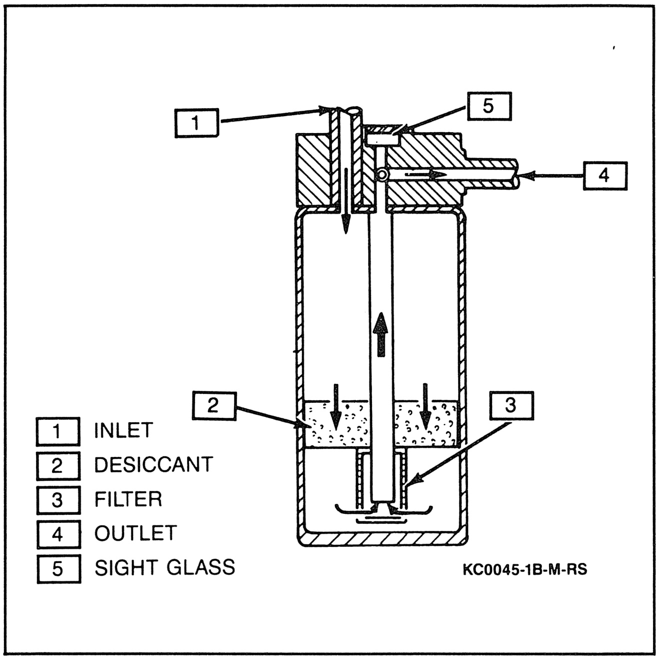

1 INLET
2 DESICCANT
3 FILTER
4 OUTLET
5 SIGHT GLASS
KC0045-1B-M-RS

Figure 2 Receiver/Dryer

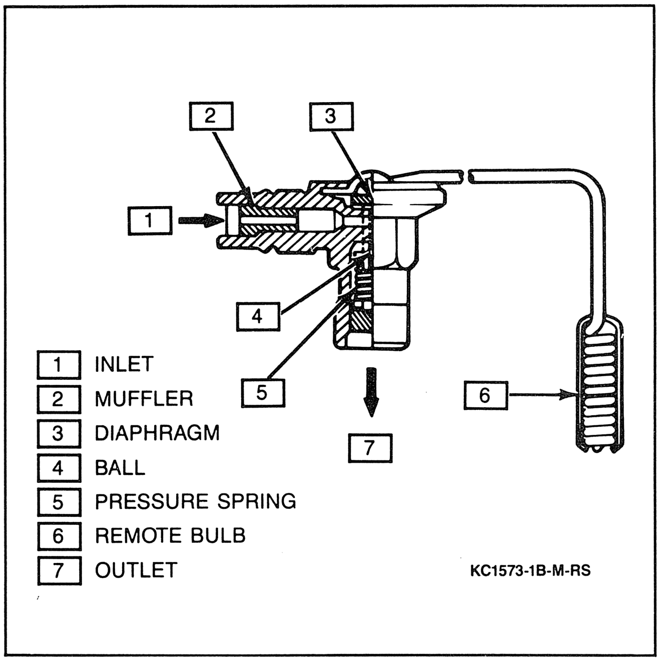

1 INLET
2 MUFFLER
3 DIAPHRAGM
4 BALL
5 PRESSURE SPRING
6 REMOTE BULB
7 OUTLET
KC1573-1B-M-RS

Figure 3 Expansion Valve

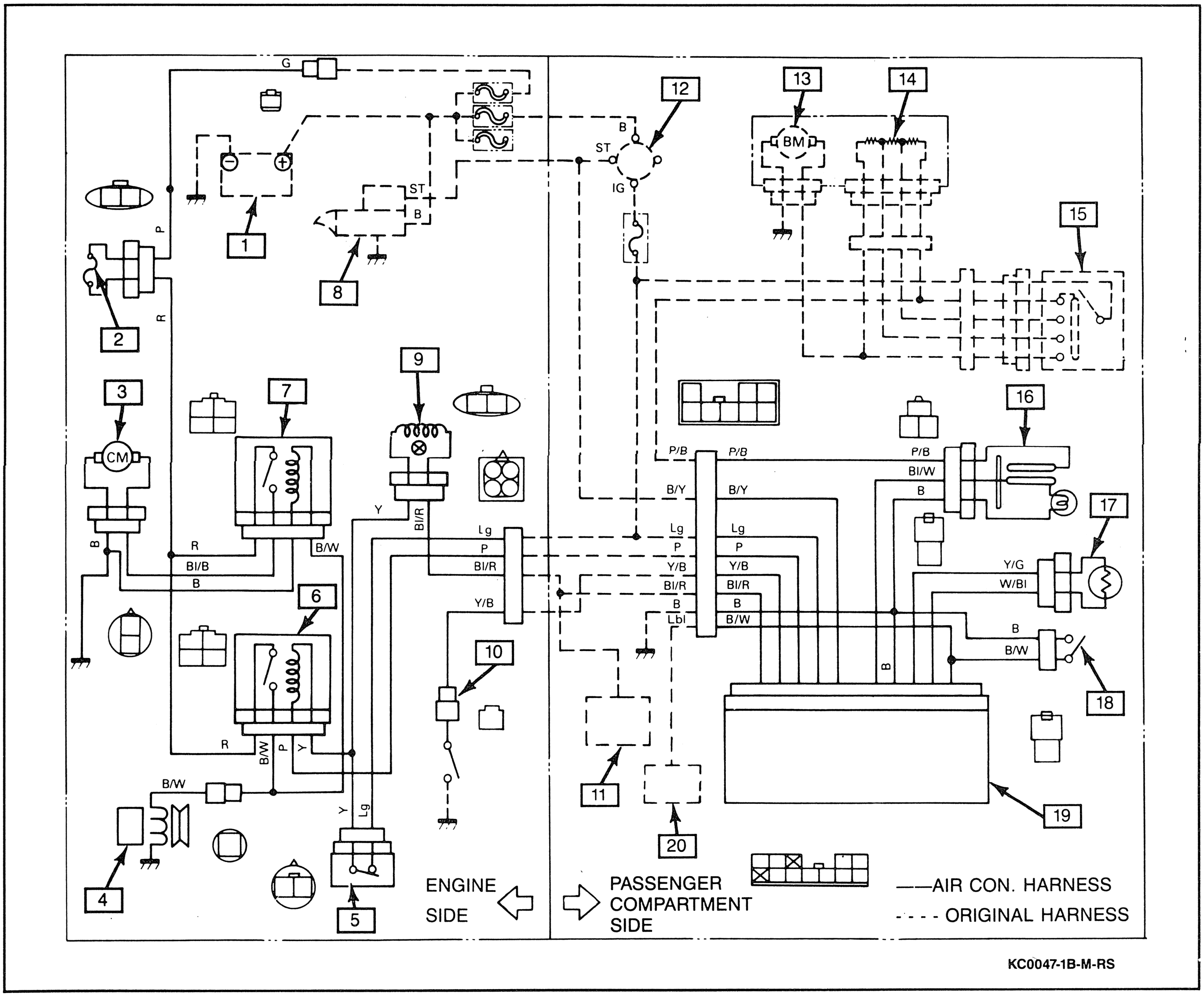

G
P
R
B
ST
IG
BM
CM
P/B
B/Y
Bl/W
Lg
Bl/R
Y/B
Lbl
B/W
Bl/B
Y
Y/G
W/Bl
ENGINE SIDE
PASSENGER COMPARTMENT SIDE
——AIR CON. HARNESS
- - - - ORIGINAL HARNESS
KC0047-1B-M-RS

Figure 4 Wiring Diagram

Number	Component
1	BATTERY
2	FUSE
3	CONDENSER FAN MOTOR
4	COMPRESSOR
5	PRESSURE SWITCH (HIGH & LOW)
6	MAGNETIC CLUTCH RELAY
7	CONDENSOR FAN MOTOR RELAY
8	STARTER
9	VACUUM SWITCHING VALVE (VSV)
10	WATER TEMPERATURE SWITCH
11	ENGINE CONTROL MODULE (ECM)
12	IGNITION SWITCH
13	BLOWER MOTOR
14	BLOWER RESISTOR
15	BLOWER MOTOR SWITCH
16	AIR CONDITIONING SWITCH
17	THERMISTOR
18	ACCELERATOR SWITCH (MANUAL TRANSAXLE (M/T) EQUIPPED VEHICLES ONLY)
19	AIR CONDITIONER AMPLIFIER
20	A/T CONTROL MODULE (AUTOMATIC TRANSAXLE (A/T) EQUIPPED VEHICLES ONLY)

Code	Color
B:	Black
B/W:	Black/White
B/Y:	Black/Yellow
BL/R:	Blue/Red
BL/B:	Blue/Black
BL/W:	Blue/White
LG:	Light Green
LBL:	Light Blue
P:	Pink
P/B:	Pink/Black
R:	Red
W/BL:	White/Blue
Y:	Yellow
Y/B:	Yellow/Black

KC0074-1B-RS

Figure 5 Wiring Diagram Legend

FUNCTION OF EACH CONTROL COMPONENT

CONDENSER FAN AND MAGNETIC CLUTCH RELAY

These relays operate the condenser fan and magnetic clutch. The condenser fan motor operates continuously, as long as the air conditioning (compressor), is under operation.

MAGNETIC CLUTCH

A device used with the engine running to operate the air conditioner only when needed and is controlled by the air conditioner amplifier.

THERMISTOR

When the evaporative temperature of the refrigerant drops to 1°C (34°F) or below, the evaporator fins will develop frost or ice, reducing the airflow, lowering the cooling capacity. The thermistor is a sensor which is used to prevent this frosting or icing of the evaporator.

The sensor, installed on the evaporator, converts the evaporator core temperature into a resistance valve which is sent to the air conditioner amplifier.

PRESSURE SWITCH

A pressure switch is used to stop the compressor operation when the cycling refrigerant is abnormally risen or dropped in pressure due to its leakage, lack, of refrigerant. The switch is installed in the high pressure line behind the receiver/dryer.

VACUUM SWITCHING VALVE (VSV)

At low speeds, such as idle, operating the compressor loads the engine. To prevent stalling, the vacuum switching valve utilizes inlet manifold vacuum to increase engine idle speed. The vacuum switching valve is controlled by signals from the engine control module (ECM) and the air conditioner amplifier.

WATER TEMPERATURE SWITCH

A water temperature switch is used to stop A/C operation if an engine overheat condition is detected. The switch will stop A/C operation if engine coolant temperature exceeds 108°C (226°F).

AIR CONDITIONER AMPLIFIER

The air conditioner amplifier is used to control the operation of the vacuum switching valve, magnetic clutch and the condenser cooling fan motor based on signals received from various sensors which detect engine operating conditions. It is installed on the lower evaporator case.

With the A/C system operating, the air conditioner amplifier control functions are as follows:

- Idle speed control (idle-up).
- Magnetic clutch delay:

  0.8 second delay after the vacuum switching valve is engaged.
- Air conditioning cutoff control:

High refrigerant pressure:
above 27 kg/cm^2 (383 psi) OFF
below 21 kg/cm^2 (229 psi) ON
Low refrigerant pressure:
below 2.1 kg/cm^2 (29.9 psi) OFF
above 2.3 kg/cm^2 (32.7 psi) ON
Engine coolant temperature:
above 108°C (226°F) OFF
below 105°C (221°F) ON
While engine is in the cranking mode OFF
Evaporator temperature:
below 1°C (34°F) OFF
While accelerating rapidly:
10 seconds (A/T equipped vehicles only) OFF

ON-VEHICLE SERVICE

AIR CONDITIONING REFRIGERANT RECOVERY AND RECYCLING (ACR^3) STATION SET UP AND REFRIGERANT RECOVERY

Figures 6 through 10

The Air Conditioning Refrigerant Recovery and Recycling Station (ACR^3) J 38100-B, is designed to be compatible with charging station J 23500-01 or its equivalent. The recovery and recycling operations are performed separately with the capability to recycle 136 kg. (30 lbs.) in one operation. Two 136 kg (30 lbs.) capacity reusable tanks are included with the station.

NOTICE: The Air Conditioning Refrigerant Recovery and Recycling Station meets UL standards for moisture and contamination removal. Recovery systems which cannot meet these standards are not approved for warranty repairs. Reuse of moisture or particulate contaminated refrigerant will result in premature compressor and other component failure.

Always wear goggles and wrap a clean cloth around fittings and/or connections when doing work that involves opening the refrigerant system. If liquid refrigerant comes into contact with the skin or eyes, injury may result.

- Before removing or replacing any of the air conditioning refrigeration lines or components, the refrigerant must be completely recovered.
- Always use service valve and pressure gage sets during evacuation and charging procedures.
- Do not charge while compressor system is hot.
- Always check the A/C system for pressure with a manifold gage set to determine if refrigerant is present in the system. Performing recovery on an A/C system which is open to the atmosphere as a result of a leak would allow the recovery station to pull only air into the tank.

CAUTION: Never remove a gage line from its adapter when the line is connected to A/C system. Always remove the line adapter from the service fitting to disconnect a line. Do not remove the charging hose at the gage set while attached to service low-side fitting. This will result in

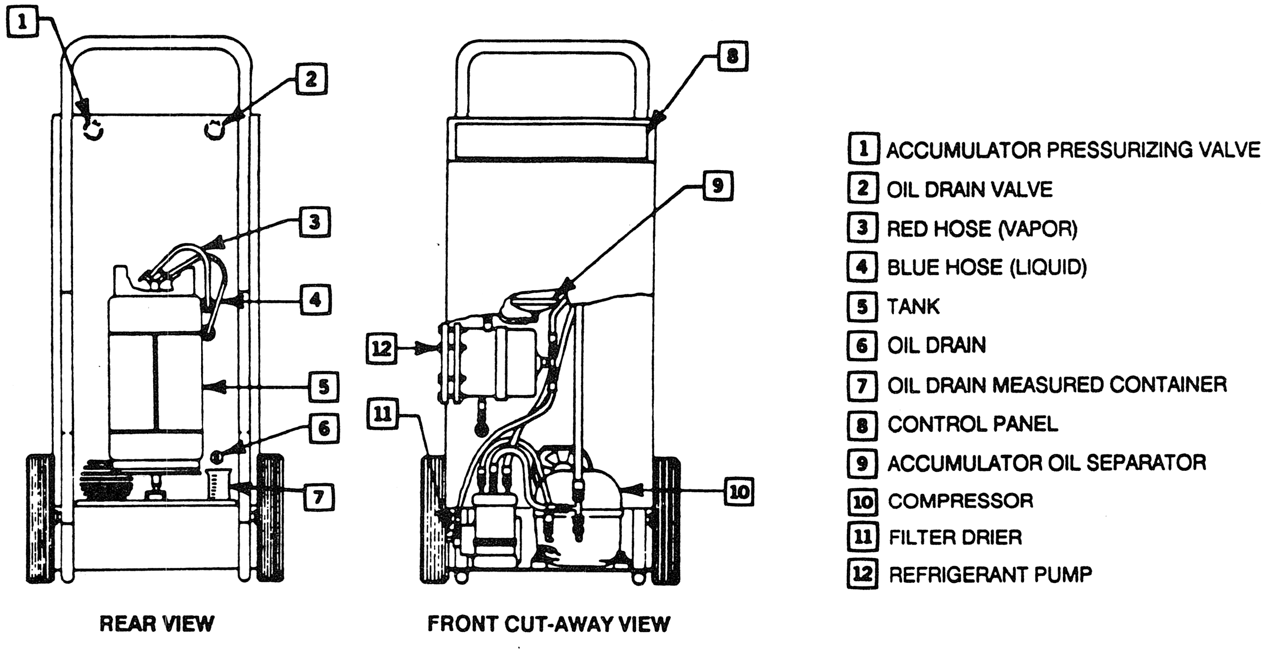

1
2
3
4
5
6
7
8
9
10
11
12
REAR VIEW
FRONT CUT-AWAY VIEW
1 ACCUMULATOR PRESSURIZING VALVE
2 OIL DRAIN VALVE
3 RED HOSE (VAPOR)
4 BLUE HOSE (LIQUID)
5 TANK
6 OIL DRAIN
7 OIL DRAIN MEASURED CONTAINER
8 CONTROL PANEL
9 ACCUMULATOR OIL SEPARATOR
10 COMPRESSOR
11 FILTER DRIER
12 REFRIGERANT PUMP
L39368-1B-JN

Figure 6 ACR^3 Component Locations

complete discharge of system due the depressed Schrader-type valve in service low-side fitting and may cause personal injury due to escaping refrigerant.

Recovery Tank Installation

CAUTION: Use authorized refillable refrigerant tanks only. Use of non-refillable tanks could cause personal injury and will void the warranty. Non-refillable tanks will affect weight platform calibration and will result in overfilled tanks. Overfilling could cause the safety valve to "pop-off" releasing a large quantity of refrigerant. If liquid refrigerant comes into contact with skin or eyes, personal injury may result.

1. The recovery tank is supplied with 68.95-103.4 kPa (10-15 psi) of dry nitrogen to keep it clean and dry during shipment. Bleed this pressure from the tank before attaching the tank to the station by removing sealing cap and opening either valve. A new tank without the precharge of dry nitrogen indicates a leak and should be immediately returned for replacement. (See instruction manual.)
2. Place the tank on the scale platform at the rear of the station. Place the bottom lip of the tank around the outside diameter of the stand-off welded to the platform. This will center the tank automatically. Loosely fasten the strap around the tank in order to prevent the tank from tipping over.
3. Attach the red hose from the back of the station to a vacuum pump. Attach the blue hose from the back of the station to the "Liquid" part of the tank.
4. Open the "Liquid" valve on the tank. Turn on the vacuum pump. Pull a vacuum on the tank and station for approximately 10 minutes to remove all unwanted air from the tank and from the station.
5. After a vacuum has been pulled, turn off the vacuum pump and disconnect the hose from the vacuum pump. Attach the red hose to the "Vapor" port on the tank and open the "Vapor" valve.
6. Perform this procedure only when putting new tanks into service.

Weight Platform Calibration

Figure 7

The weight platform should be checked for accuracy at least once a month. This calibration will ensure that the compressor will shut off when the tank is full.

CAUTION: Use of non-refillable tanks will affect platform calibration and will result in overfilling of non-refillable tanks. Overfilling could cause the safety valve to "pop-off" releasing a large quantity of refrigerant. If liquid refrigerant comes into contact with the skin or eyes, personal injury may result.

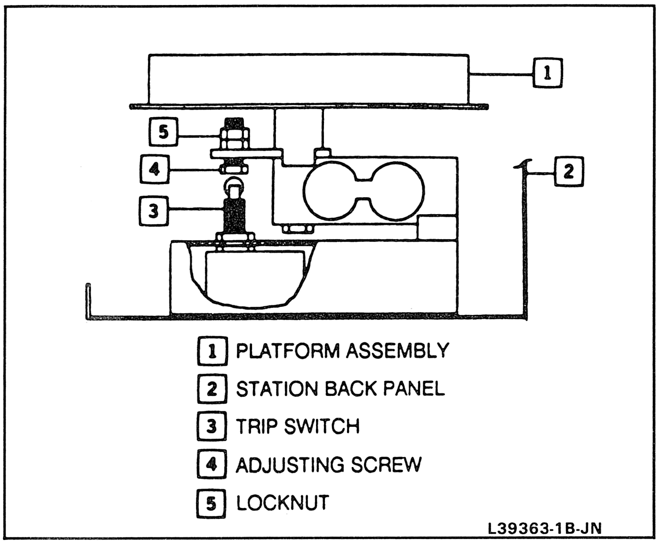


Figure 7 Weight Platform Calibration

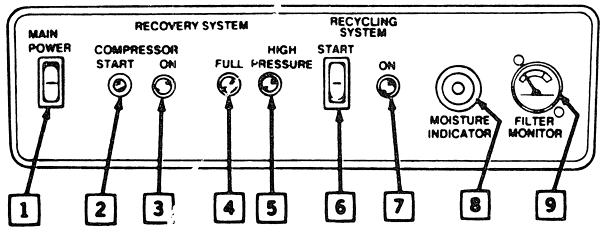
1. Place a known 45 lb. weight on the center of the platform. The switch should just trip or be very close to tripping with this amount of weight.
2. If the switch is tripped, the mechanism is in calibration. If the switch does not trip, place a 2 lbs. weight on top of the 45 lbs. weight. This weight should definitely trip the switch. If the switch is tripped, the mechanism must be recalibrated.
3. To recalibrate, remove 2 lbs. weight and loosen the lock nut of the trip screw. Turn the trip screw until the switch just trips. Remove the 45 lbs. weight.
4. To check, place 45 lb. weight on the platform and repeat step No. 2. Repeat step No. 3 as required. Tighten lock nut of the trip screw when recalibration is complete.

Control Panel

Figure 8

The control panel contains the switches and monitors as follows:

- Main Power Switch--supplies electrical power to the control panel.
- Compressor Start Switch--energizes compressor.
- Compressor On Light--lights when compressor is energized.
- High Pressure Light--lights when there is pressure above 1827 kPa (265 psi) in system.
- Recovery Full Tank Light--lights when recovery tank is full.
- Recycling System Start Switch--energizes recycling pump.
- Recycling Pump On Light--lights when recycling pump is energized.



1 MAIN POWER SWITCH - MUST BE ON TO RECOVER OR RECYCLE

2 COMPRESSOR START BUTTON

3 COMPRESSOR ON INDICATOR LIGHT

4 RECOVERY TANK FULL INDICATOR

5 HIGH VEHICLE SYSTEM PRESSURE INDICATOR

6 RECYCLING SYSTEM START SWITCH

7 RECYCLING INDICATOR LAMP

8 MOISTURE INDICATOR - YELLOW = MOISTURE GREEN = DRY

9 FILTER MONITOR - RED ZONE = REPLACE FILTER

Figure 8 Control Panel

- Moisture Indicator--tells when refrigerant is wet or dry, or when filter core needs to be replaced if no color change occurs in 2 hours of recycling.
- Filter Monitor--tells when filter is plugged.

Filter Drier Core Replacement

Guidelines for replacing the filter drier core:

- For proper contamination removal, replace the filter drier core after recycling a maximum of 300 pounds of refrigerant.
- If the moisture indicator does not change to green after two hours of filtering time, the filter drier core is saturated with moisture and should be changed.
- If the filter drier core becomes clogged with particulates, the filter monitor needle will register in the red zone; this also means the filter core should be changed.

CAUTION: Steps 2 and 3 are critical to avoid possible hazardous release of refrigerant. If liquid refrigerant comes into contact with the skin or eyes, injury may result.

NOTICE: Use only authorized filter drier cores. Use of any other cores will give unsatisfactory results and will void the warranty.

1. Close the liquid valve on the tank.
2. Attach the blue hose to the recovery inlet of the station.
3. Start the compressor and recover all refrigerant remaining in the station into the storage tank. The compressor will automatically shut off when recovery is complete.
4. Remove the bolts holding the filter cap to the shell. The filter drier core and bracket are attached to the filter cap.
5. Remove the tie rods from the filter cap and remove the filter drier core from the brackets.
6. Clean all internal parts.
7. Remove the filter drier core from the sealed can. Do not remove the filter from the can until ready to install it in the system.
8. If the filter cap gasket is damaged, replace it. Replacement gaskets are included with each filter drier core.
9. Center the spring on the filter cap and place the upper bracket on the spring with the center boss of the bracket fitting into the coil and the edges of the plate facing up.
10. Position the filter drier core on the upper bracket. Position the screened lower bracket on the filter drier core and install the tie rods. Tighten the tie rods until they stop.
11. Install the filter drier core assembly into the filter drier shell. Replace the bolts and tighten evenly, in the star pattern, to a torque of 20 N·m (15 lb. ft.).
12. When the core has been replaced and the filter drier reassembled, attach the blue hose to the vacuum pump and start the vacuum pump. Run the pump for approximately 10 minutes to remove all air.
13. Turn off the vacuum pump and disconnect the hose.
14. Reattach the blue hose to the "Liquid" port of the tank and open the "Liquid" valve on the tank. You are now ready to continue recycling with the station.

Refrigerant Recovery

Tools Required:

J 38100-B Refrigerant Recovery and Recycling System
J 23500-01 Refrigerant Charging Station
J 23575-01 Manifold Gage Set
J 36846 Hose Adapter Kit

The refrigerant system must be discharged using an Air Conditioning Refrigerant Recovery and Recycling System J 38100-B. Following this procedure, the refrigerant system can then be evacuated and charged using air conditioning service charging station J 23500-01 or equivalent, or the manifold and gage set J 23575-01 and refrigerant.

Evacuation lines from the recovery system and the charging lines from the charging station or manifold and gage set require the use of adapters to connect to the A/C system low-side service fitting. A J 36846 hose adapter kit contains all the adapters that should be required. Refer to "Special Tools" at the end of this section.

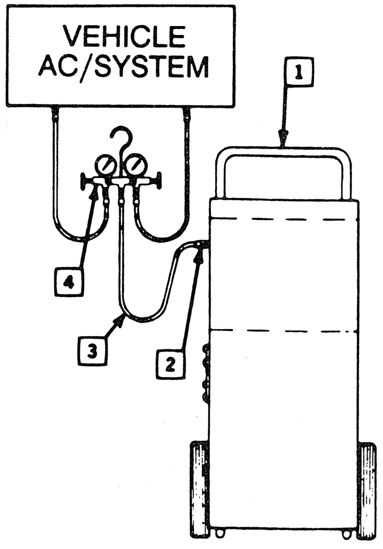
NOTICE: Failure to check for residual oil from the previous recovery can result in adding extra oil to the current vehicle being serviced. This will result in reduced performance and possible compressor damage. Refer to "Compressor Oil Distribution" earlier in this section.

1. Start vehicle and run with A/C on for 2 minutes, then attach a manifold gage set to the A/C system and attach the recovery station inlet hose to the center fitting of the manifold gage set.
2. Open both valves of the manifold gage set. Make certain the refrigerant tank "Vapor" valve and the "Liquid" valve are open.
3. Plug the station into a suitable AC power outlet and turn on the "Main Power" switch.
4. Depress the "Compressor Start" switch. The amber "Compressor On" light will come on and the compressor will start. The compressor will shut off automatically when recovery is complete. Wait 2 minutes and check for pressure rise. If a pressure rise occurs, depress the "Compressor Start" switch and allow to repeat the recovery.
5. To drain the accumulator of A/C system oil, open the "Accumulator Pressurizing" valve for 15 seconds to allow some compressor discharge pressure back into the accumulator. Open the oil drain valve slowly and drain the accumulator. When the oil stops draining, close the oil drain valve. Do not allow the accumulator to completely depressurize.
6. Although refrigerant can be filtered and recycled at any time, it is recommended to recycle when the tank is full for greatest efficiency. Two tanks are provided so you can fill one, recycle it, and use it for charging systems while filling the second tank. When the recovery tank is full, the "Trip Switch" at the bottom of the weight platform will de-energize the compressor, and the "Tank Full" light will come on. Close both tank valves, remove the tank from the platform, and replace with another refillabe tank or recycle the first tank. If the tank isn't immediately recycled, take precautions to prevent its use in A/C systems BEFORE it is recycled. Additional tanks (part #17105) are available, see the "Replacement Parts" section of your operator's manual.

Refrigerant Recycling

Figure 9

1. Plug the station into a suitable AC power outlet and turn on the main power switch.
2. Open both valves on the recovery tank.
   - For efficiency, recycle full tanks of refrigerant.
3. Turn the "Recycle Start" switch to on. The amber "Recycle On" light will come on and the refrigerant pump will start.
4. Refrigerant will be seen going through the "Moisture Indicator" at start up. If there is a sufficient supply of refrigerant, the bubbles will clear after a few seconds. When the bubbles clear from the "Moisture Indicator," the refrigerant pump is operating at maximum efficiency.



1 REFRIGERANT RECOVERY AND RECYCLING STATION
2 STATION LEFT
3 YELLOW HOSE
4 MANIFOLD GAUGE SET

Figure 9 ACR^3 Hook Up

5. Allow the station to operate until the dot in the center of the "Moisture Indicator" turns green. The "Moisture Indicator Dot" should change to the shade indicated on the reference decal. Always run the recycling system a minimum of 30 minutes. If the "Moisture Indicator" starts out yellow, it could take as long as two hours to turn green, depending on the moisture content of the refrigerant.
6. Shut off the station when recycling is complete. This is not an automatic function.

Guidelines for replacing the filter drier core:

- For proper contaminant removal, replace the filter drier core after recycling a maximum of 138 kg (300 pounds) of refrigerant.
- If the moisture indicator does not change to green after two hours of filtering time, the filter drier core is saturated with moisture and should be changed.
- If the filter drier core becomes clogged with particulates, the filter monitor needle will register in the red zone; this also means the filter core should be changed.
- If any of the recovered refrigerant being recycled is from a system with a hermetic motor burnout, run the recycling system for a minimum of 24 hours. Check the A/C

system oil from the accumulator with an acid test kit to determine the acid quantity of the oil.

Operating Hints

1. When using the recovery station in conjunction with a charging station, attach the center port hose of the manifold gage set to the inlet port of the ACR^3 station. Then follow the normal operating procedures for the recovery/recycling station.
2. When using the ACR^3 station in conjunction with an automatic charging station, attach the exhaust hose to the inlet of the ACR^3 station. On automatic A/C service stations, a hole has been added at the rear of the cabinet for convenient access to the exhaust hose. On older style stations, you must open the front doors of the cabinet to reach the exhaust hose.

   After attaching the exhaust hose to the ACR^3 station, depress the "Main Power" switch on the automatic charging station and depress the "Exhaust" switch. Then follow the normal operating procedures for the ACR^3 station.
3. Air is automatically vented from the recovery tank during recycling. This feature eliminates the need to "purge" hoses before recovering the refrigerant.
4. Operating the engine with the A/C off during recovery may reduce the recovery time by increasing the temperature in the accumulator area.
5. To help prevent the escape of refrigerant to the atmosphere, the ACR^3 can be attached to a "Dial-A-Charge" cylinder top vent port when filling the cylinder.
6. Always check the ACR^3 station for residual oil from the previous recovery. Refer to Step 5 in "Refrigerant Recovery" earlier in this section.

EVACUATING SYSTEM

1. Whenever A/C system is exposed to atmospheric air, it must be evacuated by a vacuum pump. With manifold set attached to A/C system, it should be evacuated for approximately 15 minutes (Figure 11).
2. Connect high and low charging hoses of manifold gage set as follows:

TROUBLESHOOTING GUIDE

SYMPTOM	CAUSE	CURE
High pressure light comes on and compressor stops	• Valve at tank is closed • Tank is completely full of refrigerant	• Open valve • Remove and replace tank • Check weight platform calibration or consult factory
Compressor continues operation after 17 in. vacuum has been reached	• Faulty vacuum switch	• Replace switch
Compressor starts but does not run	• High compressor temperature • Faulty thermal overload • Faulty compressor • Compressor oil quantity low	• Allow compressor to cool down • Consult factory • Remove and replace compressor • Fill compressor with fresh oil
Dot in center of moisture indicator does not change color	• Wet filter drier core • Faulty moisture indicator	• Remove and replace filter drier core • Remove and replace moisture indicator
Compressor does not pull system to the 17 in. vacuum level	• Compressor oil quantity low • Leak in system • Faulty compressor	• Fill compressor with fresh refrigeration oil • Repair leak • Remove and replace compressor
Refrigerant does not circulate	• Liquid valve on tank closed • Vapor valve on tank closed • Pump decoupled • Faulty refrigerant pump	• Open valve • Open valve • Turn pump off then restart • Remove and replace pump

L39347-1B-JN

Figure 10 Troubleshooting Guide

- High Charging Hose-Compressor Delivery Hose.
- Low Charging Hose-Compressor Suction Hose.

3. Attach center charging hose of manifold gage set to vacuum pump.
4. Operate vacuum pump and then open suction-side valve (LO) of manifold gage set. If there is no blockage in system, there will be an indication on high pressure gage. When this occurs, open the other valve (HI) of gage set.
5. Approx. 10 minutes later, the low pressure gage should show a vacuum lower than 760 mm Hg, providing no leakage exists.
6. Evacuation should be carried out for a minimum of 15 minutes.
7. Continue evacuation until low pressure gage indicates a vacuum of no less than 760 mm Hg, then close both valves.
8. Stop vacuum pump. Disconnect center charging hose from pump inlet. System is now ready to be charged with refrigerant.

HANDLING REFRIGERANT-12

CAUTION: Air conditioning systems contain Refrigerant-12. This is a chemical mixture which requires special handling procedures to avoid personal injury.

Always wear goggles and wrap a clean cloth around fittings, valves and connections when performing work that involves opening the refrigerant system. Always work in a well ventilated area and do not weld or steam clean on or near any vehicle when installing air conditioning lines or components.

If Refrigerant-12 should come in contact with any part of the body, flush the exposed area with cold water and immediately seek medical help.

All Refrigerant-12 drums are shipped with a heavy metal screw cap. The purpose of the cap is to protect the valve and safety plug from damage. It is good practice to replace the cap after each use of the drum for this same reason.

If it is necessary to transport or carry any container of Refrigerant-12 in a vehicle, do not carry it in the passenger compartment.

If the occasion arises to fill a drum of Refrigerant-12, never fill the drum completely. Space should always be allowed above the liquid for expansion.

HANDLING OF REFRIGERANT LINES AND FITTINGS

All metal tubing lines should be free of dents or kinks to prevent loss of system capacity due to line restriction.

- The flexible hose lines should never be bent to a radius of less than four (4) times the diameter of the hose.
- The flexible hose lines should never be allowed to come within a distance of 63.5 mm (2.5 in.) of the exhaust manifold.
- Flexible hose lines should be inspected regularly for leaks or brittleness and replaced with new lines if deterioration or leaking is found.
- When disconnecting any fitting in the refrigerant system, the system must first be discharged of all refrigerant-12. However proceed very cautiously regardless of gage readings. Open very slowly, keeping face and hands away so that no injury can occur if there happens to be liquid Refrigerant-12 in the line. If pressure is noticed when fitting is loosened, allow it to bleed off.

CAUTION: Should Refrigerant-12 strike your eye(s), consult a doctor immediately.

CAUTION: DO NOT USE YOUR HAND TO RUB THE AFFECTED EYE(S). Instead, use quantities of fresh cold water to splash over the affected area to gradually raise its temperature above the freezing point.

CAUTION: Obtain proper treatment as soon as possible from a doctor or eye specialist. Should the liquid R-12 touch the skin, the injury must be treated the same as skin which has been frostbitten or frozen.

PROCEDURE OF CHARGING

Figures 11 thru 15

1. Make sure the evacuation process has the correct routing (Figure 12).
2. Connect manifold gage set in position. Remove slack in the hose connected to the drum refrigerent valve to purge charging line. Then open low pressure-side valve.

NOTICE: Make sure the high pressure-side valve is closed securely.

3. Start the engine and let run at fast idle (1000 ± 50 rpm) with the air conditioner on.
4. Charge A/C system with refrigerant in vapor state only. Refrigerant drum must be upright.
5. If refrigerant is found to be escaping, a "Hiss" sound may be heard between refrigerant drum and charging line. Immediately close refrigerant drum valve as well as manifold gage set low pressure valve (Figure 13).
6. Check charging line fitting at drum for looseness. Tighten as necessary and continue charging.
7. After the system has been charged to the specified amount of 500g (17.6 oz), or when the low and high pressure gages have indicated approx. 2 and 15 kg/cm^2 (28 and 213 psi), close the low pressure-side hand valve of the manifold gage set (Figure 14). At this time, the receiver/dry should show no bubbles in the sight glass, indicating that the system if fully charged (Figure 15).

REMOVING MANIFOLD GAGE SET

When the A/C system has been charged with the specified amount of refrigerant, remove the manifold gage set as follows:

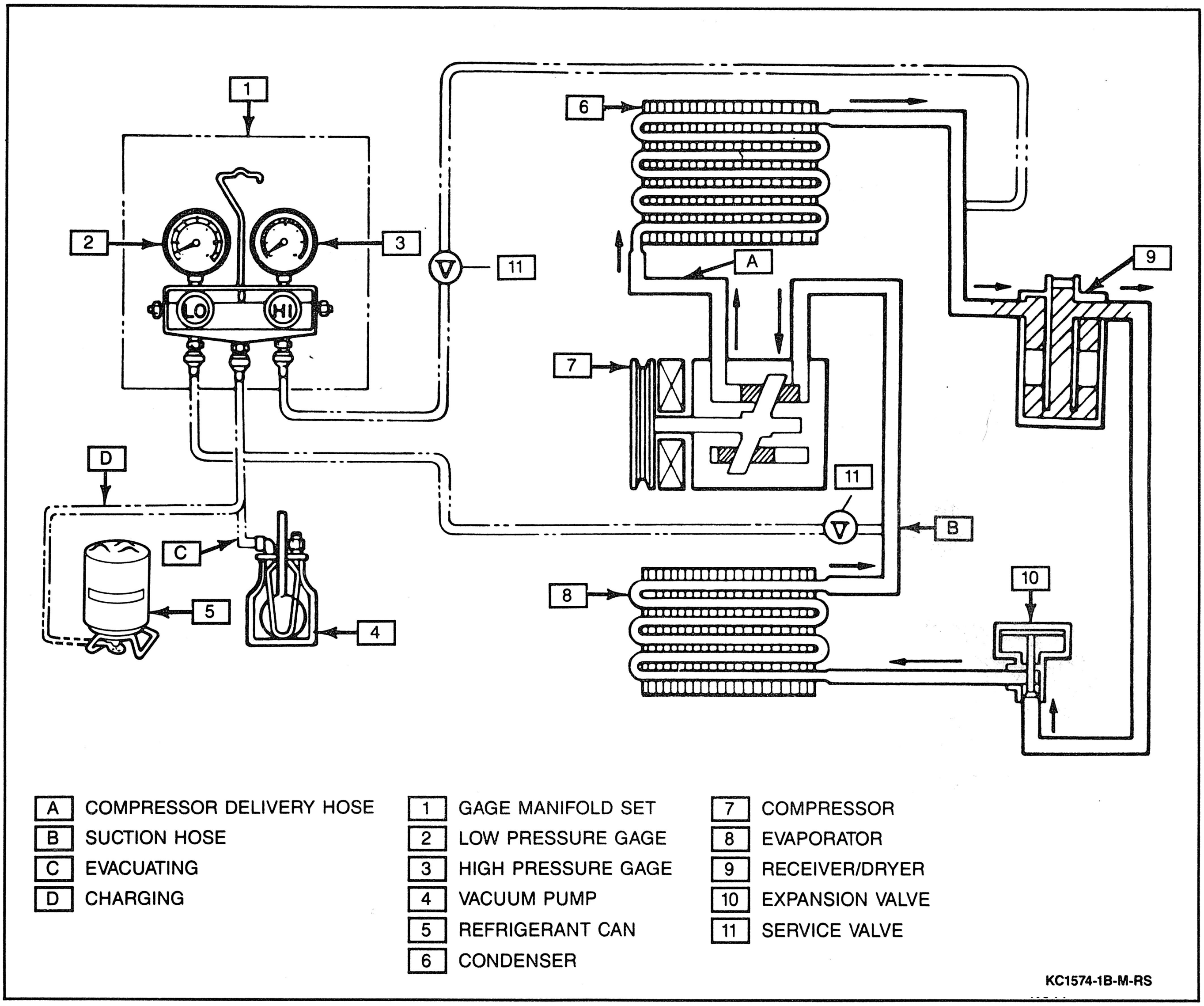

1
2
3
LO
HI
11
6
A
9
7
D
11
B
C
5
4
8
10
A COMPRESSOR DELIVERY HOSE
B SUCTION HOSE
C EVACUATING
D CHARGING
1 GAGE MANIFOLD SET
2 LOW PRESSURE GAGE
3 HIGH PRESSURE GAGE
4 VACUUM PUMP
5 REFRIGERANT CAN
6 CONDENSER
7 COMPRESSOR
8 EVAPORATOR
9 RECEIVER/DRYER
10 EXPANSION VALVE
11 SERVICE VALVE
KC1574-1B-M-RS

Figure 11 A/C System

1. Close the low-pressure-side valve of the manifold gage set. (The high-pressure-side valve is closed continuously during the process of charging.)
2. Fully tighten the handle of the refrigerant drum valve.
3. Stop the engine.
4. Using a shop rag, remove charging hoses from the service valves. This operation must be performed rapidly.
5. Put caps on the service valves of the system.

CAUTION: High pressure side is under extreme high presure. Care should be taken to protect eyes and skin.

LEAK TESTING THE REFRIGERANT SYSTEM

Whenever a refrigerant leak is suspected in the system or when service operations performed result in disturbing lines or connections, it is advisable to test for leaks. Common sense should be used in performing any refrigerant leak test, since the need and extent of any such test will, in general, depend upon the nature of a complaint and the type of service performed on the system.

Liquid Leak Detectors

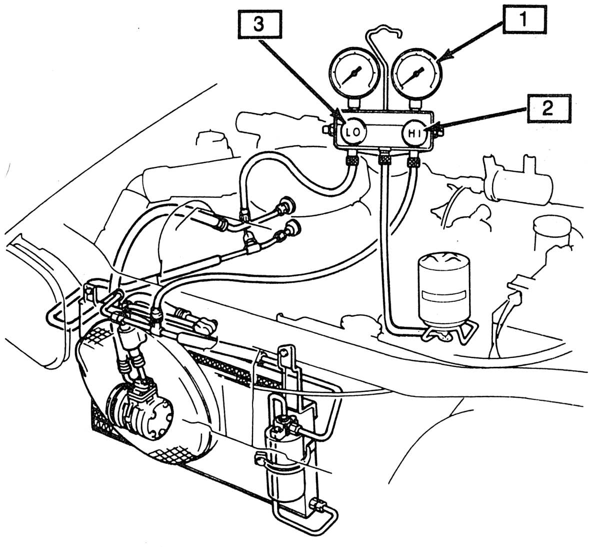
There are a number of fittings and locations throughout the air conditioning system where a liquid leak detector solution may be used to pinpoint refrigerant leaks. By merely applying the solution to the area in question with a swab, bubbles will form within seconds if there is a leak.

For restricted access areas, such as sections of the evaporator and condenser, an electronic leak detector, such as J29547 or equivalent is more practical for determining and locating leaks.

Electronic Leak Testers

Electronic leak testers are used in areas that are difficult to test with liquid leak detectors due to poor visibility or inaccessibility.

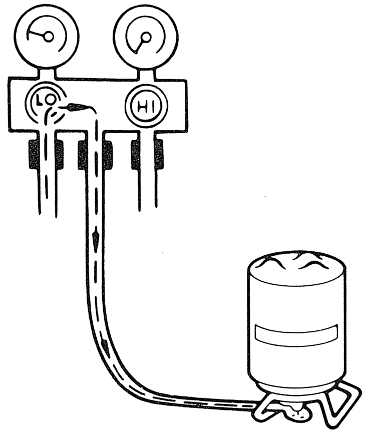
Refrigerant Leak Detector J 29547 is a portable, battery operated model. This model provides audible signals to indicate leak detection (Figure 16).



1 MANIFOLD GAGE SET
2 HIGH PRESSURE SIDE (DELIVERY SIDE HOSE)
3 LOW SIDE PRESSURE (SUCTION SIDE HOSE)

KC0050-1B-M-RS

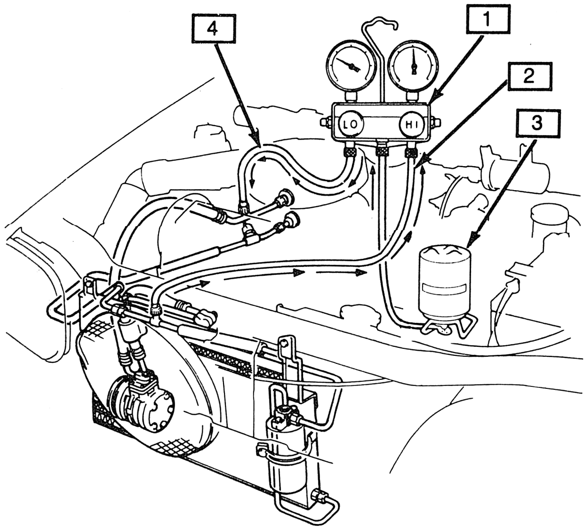
Figure 12 Manifold Gage Set



KC1577-1B-M-RS

Figure 13 Purging Refrigerant

The successful use of electronic leak detectors depends upon carefully following the manufacturer's instructions regarding calibration, operation and maintenance. Battery condition is especially important to the accuracy of the portable battery powered model J 29547 and should be monitored by the low battery indicator (Figure 16).



1 MANIFOLD GAGE SET
2 HIGH PRESSURE SIDE (DELIVERY SIDE HOSE)
3 REFRIGERANT CAN
4 LOW SIDE PRESSURE (SUCTION SIDE HOSE)

KC0053-1B-M-RS

Figure 14 Manifold Gage Set

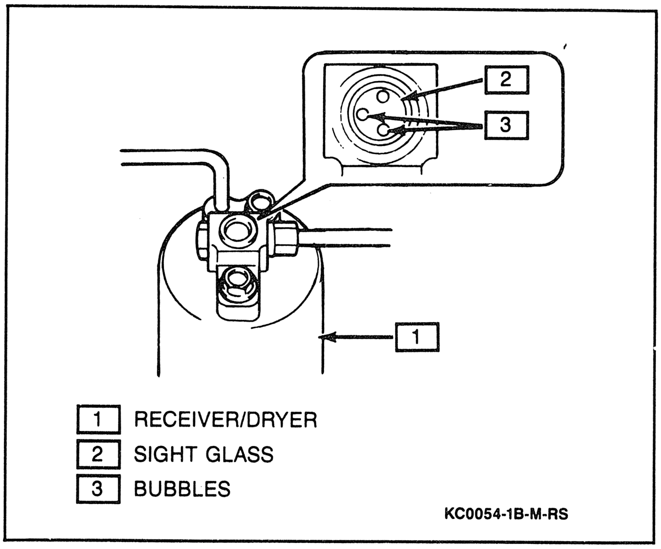

1
2
3
1 RECEIVER/DRYER
2 SIGHT GLASS
3 BUBBLES
KC0054-1B-M-RS

Figure 15 Sight Glass

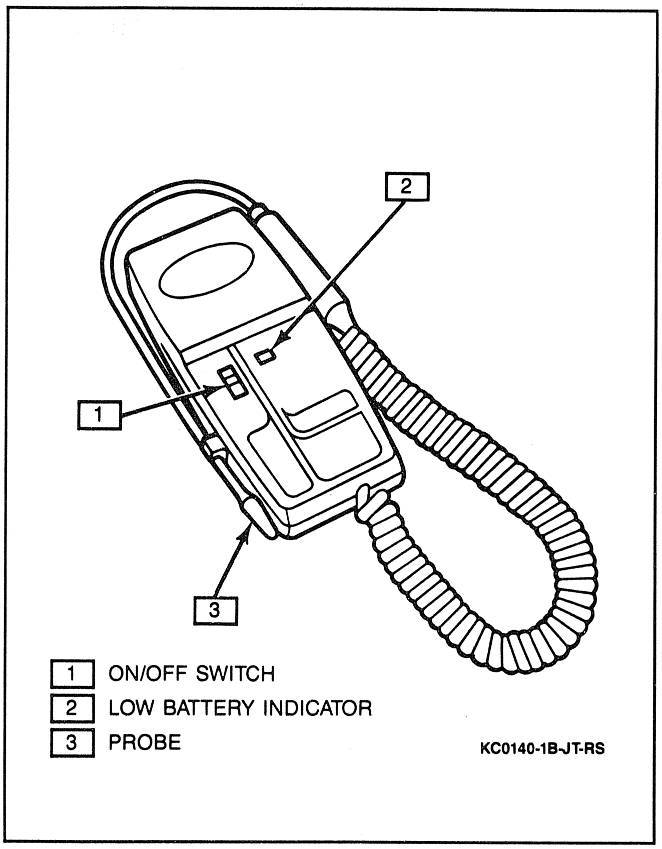

1
2
3
1 ON/OFF SWITCH
2 LOW BATTERY INDICATOR
3 PROBE
KC0140-1B-JT-RS

Figure 16 Electronic Leak Detector J29547

DIAGNOSIS

CONDITION	POSSIBLE CAUSE	CORRECTION
No cooling or warm air.	Magnetic clutch does not engage properly.	
	● Fuse blown.	Replace fuse and check for short.
	● Magnetic clutch faulty.	Check clutch.
	● A/C switch faulty.	Check switch.
	● Temperature control switch faulty.	Check switch.
	● Low pressure switch faulty.	Check switch.
	Wiring or grounding faulty.	Check A/C circuit.
No refrigerant. Compressor is not rotating properly.	Drive belt loosened or broken.	Tighten or replace drive belt.

CONDITION	POSSIBLE CAUSE	CORRECTION
No refrigerant. Compressor is not rotating properly. (cont.).	Compressor faulty.	Check compressor.
	Blower inoperative.	Check heater.
	Expansion valve faulty.	Check expansion valve.
	Leak in system.	Check system for leaks.
	Receiver/dryer has blown fusible plug or clogged scres.	Check receiver/dryer.
Cool air comes out only intermittently.	Magnetic clutch slipping.	Check magnetic clutch.
	Wiring connection faulty.	Repair as necessary.
	Excessive mositure in system.	Evacuate and charge system.
Cool air comes out only at high speeds.	Condenser clogged.	Check condenser.
	Drive belt slipping.	Check or replace drive belt.
	Compressor faulty.	Check compressor.
	Insufficient or excessive charge of refrigerant.	Check charge of refrigerant.
	Air in system.	Evacuate and charge system.
Insufficient cooling.	Condenser clogged.	Check condenser.
	Drive belt slipping.	Check or replace drive belt.
	Magnetic clutch faulty.	Check magnetic clutch.
	Compressor faulty.	Check compressor.
	Expansion valve faulty.	Check expansion valve.
	Temperature control switch faulty.	Check temperature control switch.
	Too little or too much charge of refrigerant.	Check charge of refrigerant.
	Air or excessive compressor oil in system.	Evacuate and charge system.
Insufficient velocity of cooled air.	Evaporator clogged or frosted.	Check evaporator.
	Air leaking from evaporator case or air duct.	Repair as necessary.
	Air inlet blocked.	Repair as necessary.
	Blower motor faulty.	Replace blower motor.

ON-VEHICLE SERVICE

NOTICE: When servicing air conditioning system, the following rules must be observed.

WIRING PRECAUTIONS

1. Disconnect battery negative terminal.
2. Connect wire connectors securely.
3. Use approved electrical or original clamps to reconnect air conditioner wire harness to main wire harness.
4. If harness has been disconnected or removed while servicing, install and/or connect harness in original position.
5. During installation, be careful not to pinch air conditioner wire harnesses.
6. When additional wires are required, wire with the same gauge of wire. Tape each connection.
7. Keep wire harness away from any moving or high temperature components.
8. Keep connecting fittings away from fuel lines.
9. Make sure wire harness does not come in contact with sharp edges or corners.

REFRIGERANT LINES PRECAUTIONS

1. Never use heat for bending pipes. When bending a pipe, try to make its bending radius as slight as possible.
2. Keep internal parts of air conditioner free from moisture and dirt. When disconnecting any line from system, install a blind plug or cap to the fitting immediately.
3. When connecting hoses and pipes, apply a few drops of refrigerant oil to seats of flared nuts and "O" rings.
4. When tightening or loosening a fitting, use two wrenches: one for turning and the other for support.
5. Be sure of correct line installation to the receiver/dryer. Inlet fitting must be connected to condenser outlet fitting.
6. Tighten flared nuts according to Figure 17.
7. Route drain hose so that drained water does not contact vehicle components.

FLARED NUT USED FOR	TIGHTENING TORQUE	
	N·m	lb-ft
1/4 inch pipe	10 - 15	7.7 - 11.0
3/8 inch pipe	20 - 30	14.5 - 21.5
1/2 inch pipe	30 - 40	21.5 - 29.0
5/8 inch pipe	40 - 50	29.0 - 36.0

KC0141-1B-JT-RS

Figure 17 Flared Nut Specifications Chart

CHARGE OF REFRIGERANT

Figure 18

The following procedure can be used for quickly checking whether the A/C system has a proper charge of refrigerant. Run engine at fast idle and operate air conditioner at max cooling capacity for a few minutes. Then look at sight glass on top of the receiver/dryer. Compare what is observed with symptoms listed in checking Refrigerant Charge Chart within this section.

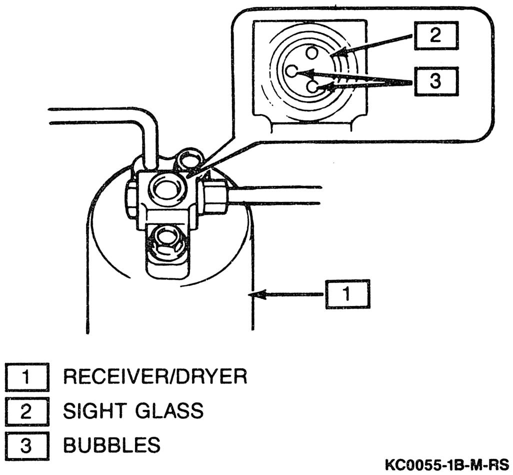


Figure 18 Receiver/Dryer

REFRIGERANT CHARGE CHART

CONDITION	CHARGE OF REFRIGERANT	CORRECTION
1) Bubbles observed in sight glass.	Insufficient charge of refrigerant in system.	Check system for leaks with a leak tester.
2) No bubbles observed in sight glass.	Insufficient charge of refrigerant in system.	Refer to items 3 and 4.
3) No temperature diffe-rance betwen inlet and outlet.	Empty or nearly empty system.	Evacuate and charge system and then check it for leaks.

CONDITION	CHARGE OF REFRIGERANT	CORRECTION
		with a leak tester.
4) Noticeable temperature difference between compressor inlet and outlet.	Proper or too much charge of refrigerant in system.	Refer to items 5 and 6.
5) When air conditioner is turned OFF, refrigerant in sight glass clears immediately and remains clear.	Too much charge of refrigerant in system.	Discharge excess refrigerant.
6) When air conditioner is turned OFF, refrigerant in sight glass produces foam and remains clear.	Proper charge of refrigerant in system.	NO CORRECTION NEEDED BECAUSE CHARGE OF REFRIGERANT IS NORMAL.

CONDENSER

Inspect

- The condenser fins for blockage, the condenser fittings for leakage and the condenser fins for damage. Clogged condenser fins should be washed with water and should be dryed with compressed air.

NOTICE: Be careful not to damage the condenser fins. If any condenser fins are bent, straighten them using a screwdriver or pair of pliers. If any leakage is found from the fitting or tube, repair or replace the condenser.

Remove or Disconnect

1. Slowly discharge and recover refrigerant from the high pressure-side service valve. Quick discharge causes compressor oil to escape together with refrigerant. So, care must be used to avoid any quick discharge. Refer to "Air Conditioning Refrigerant Recovery and Recycling (ACR^3) Station Set Up and Refrigerant Recovery" earlier in this section.
2. Compressor delivery hose from condenser inlet fitting and receiver/dryer outlet line at fitting above the condenser cooling fan. As soon as above hose and line are disconnected, cap opened fittings so that moisture and dust do not enter the condenser.
3. Hood latch and hood lock assembly from vehicle. Refer to BUMPERS, SHEET METAL AND FRAME (SECTION 2).
4. Condenser cooling fan electrical connector.
5. Condenser assembly attaching bolts and remove the condenser, condenser cooling fan and receiver/dryer as an assembly.

NOTICE: Exercise care not to damage fins of the condenser during removal.

6. Receiver/dryer inlet fitting from condenser assembly.
7. Receiver/dryer bracket attaching screw and receiver/dryer from condenser assembly.
8. Condenser cooling fan mounting bolts and fan from the condenser assembly.

Install or Connect

1. Condenser cooling fan to condenser assembly and condenser cooling fan mounting bolts to fan.
2. Receiver/dryer to condenser assembly and receiver/dryer bracket attaching screw to bracket.
3. Receiver/dryer inlet fitting to condenser assembly.
4. Receiver/dryer, condenser cooling fan and condenser as an assembly to vehicle.

NOTICE: When replacing the condenser, add 20 to 30 cc (0.7 to 1.0 oz.) of refrigerant oil from compressor suction-side.

5. Condenser cooling fan electrical connector.
6. Hood lock member and hood latch to vehicle.
7. Compressor delivery hose to inlet fitting and receiver/dryer outlet line at fitting above condenser cooling fan.
8. Evacuate and charge refrigerant system. See "Evacuating System" and "Charging Procedure" earlier in this section.

RECEIVER/DRYER

Inspect

- Use a leak tester to check for leakage around the sight glass, fusible plug and fittings.

Remove or Disconnect

1. Slowly discharge and recover refrigerant from the high pressure-side service valve. Quick discharge causes compressor oil to escape together with refrigerant, so care must be used to avoid any quick discharge. Refer to "Air Conditioning Refrigerant Recovery and Recycling (ACR^3) Station Set Up and Refrigerant Recovery" earlier in this section.
2. Liquid lines from the receiver/dryer inlet and outlet fittings.

   NOTICE: Cap up the opened fittings so that moisture and dust do not enter the receiver/dryer.
3. Receiver/dryer bracket attaching screw and receiver/dryer from bracket.

Install or Connect

1. Receiver/dryer and bracket attaching screw to receiver/dryer bracket.

   NOTICE: When replacing the receiver/dryer, add 10cc (4 oz) of refrigerant oil from compressor suction-side. Blind plugs of the receiver/dryer should not be removed until just before the receiver/dryer is installed.
2. Liquid lines to receiver/dryer inlet and outlet fittings.
3. Evacuate and charge refrigerant system. Refer to "Evacuating System" and "Charging Procedure" earlier in this section.

EVAPORATOR

Figures 19 through 24

Inspect

1. Connect manifold gage set to A/C system (See procedure in this section).
2. Run engine at fast idle with A/C switch ON.
3. Verify that the low pressure gage shows a reading of 0.5 kg/cms - 5.0 kg/cm^2 (7 - 70 psi).

   NOTICE: If reading is too low (i.e., below 0.5 kg/cm^2, 7 psi), check the expansion valve and/or the receiver/dryer and replace as necessary. If reading is too high (i.e., above 5.0 kg/cm^2, 70 psi), tighten the remote bulb holder to replace the expansion valve.

Remove or Disconnect

1. Negative battery cable.
2. Discharge and recover refrigerant from system. Refer to "Air Conditioning Refrigerant Recovery and Recycling (ACR^3) Station Set Up and Refrigerant Recovery" earlier in this section.

   NOTICE: Care should be exercised during discharge to avoid excess refrigerant oil discharge with the refrigerant.
3. Two attaching screws from glove box striker and remove striker.
4. One attaching screw from rear of the glovebox upper panel and remove panel.
5. Blower motor and blower resistor electrical connectors.
6. Fresh/recirc control cable from blower case assembly.
7. Three blower case mounting bolts and case from the vehicle (Figure 19).

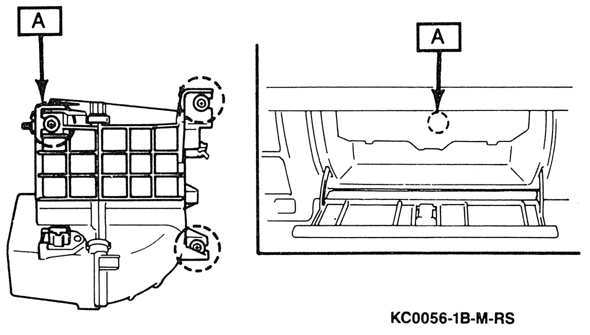


Figure 19 Blower Case Removal

8. Air conditioner amplifier and evaporator thermistor electrical connectors.
9. Compressor suction line and receiver/dryer outlet line from evaporator.

   NOTICE: Fittings must be capped so that moisture and dust cannot enter the evaporator assembly.
10. One upper evaporator mounting bolt and one lower evaporator mounting nut from the evaporator case.
11. Evaporator case from the vehicle and drain hose from evaporator case.
12. Air conditioner amplifier from the evaporator case by carefully releasing 2 lower lock tabs and sliding amplifier upward to disengage from evaporator case (Figure 20).

Install or Connect

1. Air conditioner amplifier to evaporator case.
2. Evaporator drain hose to case and case to vehicle.
3. One upper evaporator mounting bolt and 1 lower evaporator mounting to evaporator case.
4. Receiver/dryer outlet line, compressor suction line to evaporator.
5. Air conditioner amplifier and evaporator thermistor electrical connectors.
6. Blower case to vehicle and 3 blower case mounting screws to case.
7. Fresh/recirc cable to blower case assembly.

   ### Adjust

   - Control cable. Refer to HEATING AND VENTILATION (SEC.1A).
8. Blower motor and blower resistor electrical connectors.

9. Glove box upper panel to instrument panel carrier assembly and 1 attaching screw to rear of panel.
10. Blove box striker to glove box upper panel and 2 attaching screws to striker.
11. Battery negative (-) cable.
12. Evacuate and charge refrigerant system. Refer to "Evacuating System" and "Charging Procedures" earlier in this section.

Disassemble

1. Evaporator case from vehicle. Refer to "Evaporator" earlier in this section.
2. Detach all retaining clamps to separate the evaporator upper and lower case halves from each other (Figure 20 and 21).

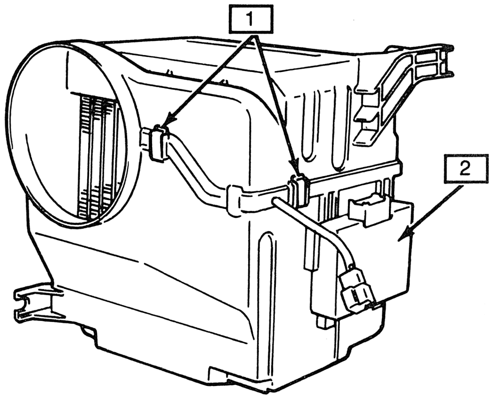

1
2
1 CLAMPS
2 AIR CONDITIONER AMPLIFIER
KC0057-1B-M-RS

Figure 20 Evaporator

3. Remove case cover (2 pieces) to remove the evaporator core out of position (Figure 21).
4. Detach the following components from the evaporator core (Figure 22):
   - Expansion valve.
   - Thermistor.

Inspect

1. Check the evaporator core fins for blockage. If found clogged, use compressed air to clean the fins.

NOTICE: Do not use water for cleaning the evaporator.

2. Check the inlet and outlet fittings for cracks or scratches. Repair as required.

Expansion Valve

Figures 23 and 24

Remove or Disconnect

1. Evaporator core from evaporator case (See procedure in this section).

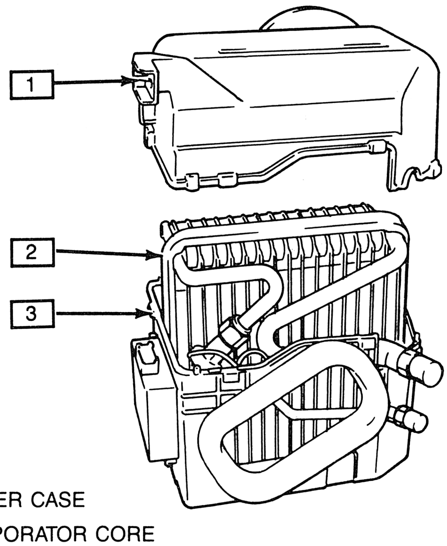

1
2
3
1 UPPER CASE
2 EVAPORATOR CORE
3 LOWER CASE
KC0058-1B-M-RS

Figure 21 Upper and Lower

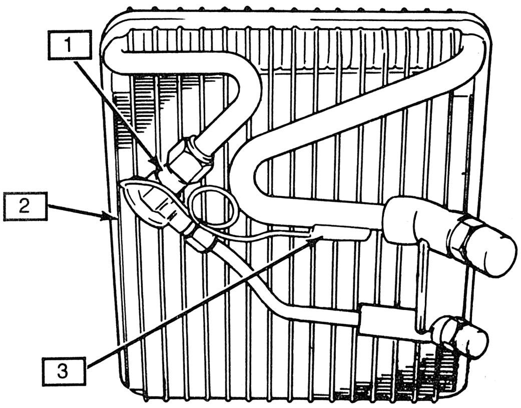

1
2
3
1 EXPANSION VALVE
2 EVAPORATOR CORE
3 REMOTE BULB
KC0059-1B-M-RS

Figure 22 Evaporator and Remote Bulb

2. Evaporator expansion valve from evaporator core.

Inspect

1. Connect the manifold gage set to the expansion valve and its charging hose to the refrigerant drum (Figure 23).
2. Soak the remote bulb of the expansion valve in water contained in a water pan (Figure 23).
3. Close both the low and high pressure valves.
4. Open valve to the refrigerant drum.
5. Open the high pressure valve to adjust the pressure to approx. 5.0 kg/cm^2 (70 psi).

6. Read the pressure indicated on the low pressure gage. At the same time, use a thermometer to measure the water temperature.
7. Use the pressure temperature relationship chart to check whether the above measurements fall within the shaded acceptable range (Figure 24).

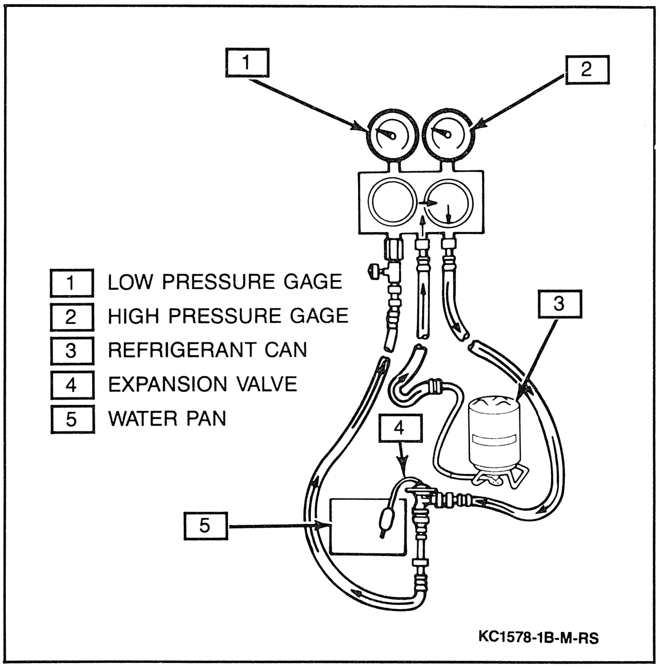


Figure 23 Expansion Valve Operation

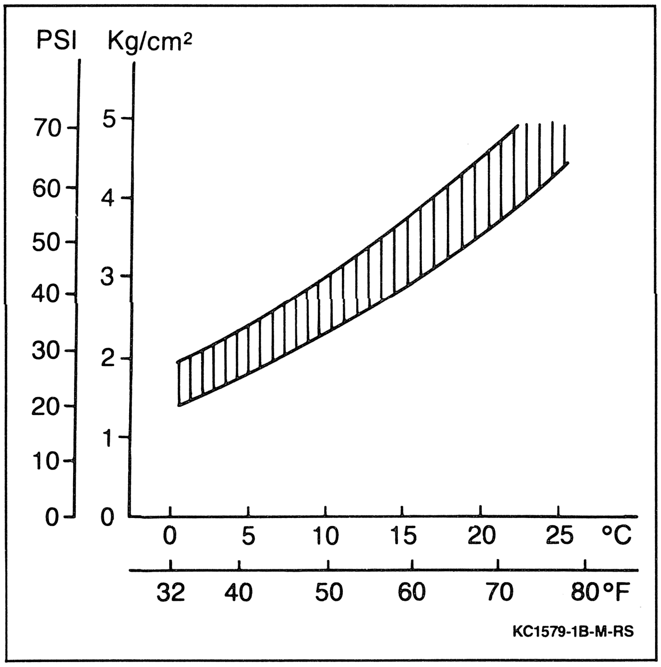


Figure 24 Pressure Temperature Relationship Chart

Install or Connect

1. Expansion valve to evaporator core, evaporator core to evaporator case and case to vehicle (See procedure in this section).
2. Evacuate and charge the system. Refer to "Evacuating System" and "Charging Procedure" earlier in this section.

Evaporator Thermistor

The thermistor is a temperature sensor used to measure the temperature of discharged air from the evaporator. As air temperature decreases, the resistance of the sensor increases. When air temperature becomes lower than 1°C (34°F), the signal sent from the thermistor to the air conditioner amplifier will cause the amplifier to disengage the A/C magnetic clutch. This is to prevent the evaporator from freezing.

Remove or Disconnect

1. Evaporator core from evaporator case.
2. Evaporator thermistor from evaporator core.

Inspect

1. Use an ohmmeter to measure resistance of the thermistor and simultaneously using a thermometer, measure room temperature.
2. Use the resistance temperature relationship chart to check whether the above measurements fall within the shaded acceptable range (Figure 25).

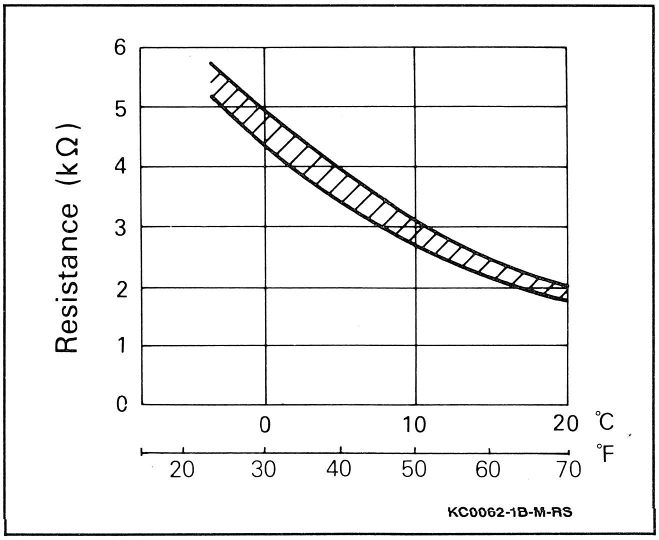


Figure 25 Resistance Temperature Relationship Chart

Install or Connect

1. Evaporator thermistor to evaporator core.
2. Evaporator core to evaporator case to vehicle (See procedure in this section).
3. Evacuate and charge the refrigerant system. Refer to "Evacuating System" and "Charging Procedure" earlier in this section.

Water Temperature Switch

Figure 26

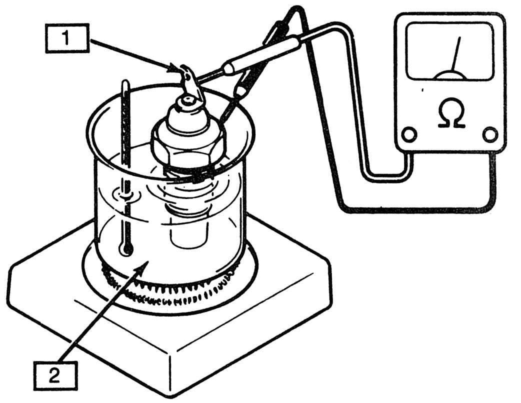
Remove or Disconnect

1. Battery negative (-) cable.
2. Temperature switch electrical connector.
3. Temperature switch from cylinder head.

NOTICE: Temperature switch is located to the rear of the coolant thermostat assembly.

Inspect

1. Heat water temperature switch and using an ohmmeter, check for continuity as shown in (Figure 26).
2. Continuity should exist at or above 108°C (226°F). If check is not within specification, the switch must be replaced.



1 WATER TEMPERATURE SWITCH
2 SILICON OIL OR GLYCERIN

KC0063-1B-M-RS

Figure 26 Water Temperature Switch Inspection

Install or Connect

1. Temperature switch to cylinder head.
2. Temperature switch electrical connector.
3. Battery negative (-) cable.

REFRIGERANT LINES AND HOSES

Inspect

- Use leak test procedure outlined in this section to check hoses and lines for any refrigerant leakage.
- Check to see if each hose or line has any loose or damaged clamps or fittings. Retighten fittings and/or clamps. Replace clamp(s), hoses or lines as required.

Remove or Disconnect

1. Discharge and recover refrigerant from system. Refer to "Air Conditioning Refrigerant Recovery and Recycling (ACR³) Station Set Up and Refrigerant Recovery" earlier in this section.
2. Hose or line. Refer to "Air Conditioning Refrigerant Recovery and Recycling (ACR³) Station Set Up and Refrigerant Recovery" earlier in this section.

NOTICE: As soon as the above hose or line is disconnected, be sure to cap opened fitting from which it is disconnected to prevent moisture and dust from entry.

Install or Connect

1. Refrigerant hose or line.
2. Evacuate and charge refrigerant system. Refer to "Evacuating System" and "Charging Procedure" earlier in this section.

A/C SWITCH

Figure 27

Remove or Disconnect

1. Battery negative (-) cable.
2. A/C switch electrical connector.
3. Carefully remove switch through the front of the instrument panel bezel.

Inspect

1. Use an ohmmeter to check A/C switch for proper continuity between each terminal (Figure 27).
2. If switch shows no continuity, replace it.

TERMINAL / POSITION	PINK/ BLACK	BLUE	BLACK
OFF			
ON	○——	——○	

KC0142-1B-JT-RS

Figure 27 Switch Continuity Chart

Install or Connect

1. A/C switch through front of instrument panel bezel.
2. A/C switch electrical connector.
3. Battery negative (-) cable.

PRESSURE SWITCH

Figure 28

Inspect

1. Check the switches for continuity at normal temperature (approx. 25°C, 77°F) when the A/C system has a proper charge of refrigerant and the A/C system (compressor) is in operation. In each of these cases, the switches (Low and High) should show proper continuity.
2. When the pressure is 2.11 kg/cm² (30 psi) or below, the low pressure switch should show no continuity, and when the pressure is 27.0 kg/cm² (383 psi) or above, the high pressure switch should show no continuity.

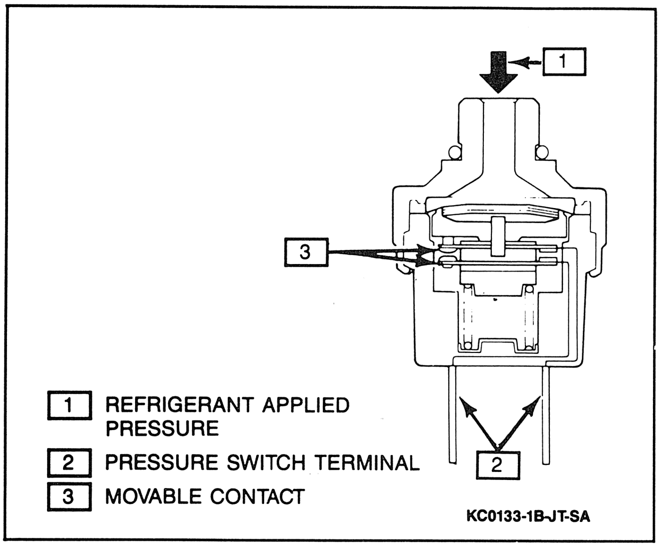

1
3
2
1 REFRIGERANT APPLIED PRESSURE
2 PRESSURE SWITCH TERMINAL
3 MOVABLE CONTACT
KC0133-1B-JT-SA

Figure 28 Pressure Switch

Remove or Disconnect

1. Battery negative (-) cable.
2. Discharge and recover refrigerant from system. Refer to "Air Conditioning Refrigerant Recovery and Recycling (ACR^3) Station Set Up and Refrigerant Recovery" earlier in this section.

   NOTICE: Care should be exercised during discharge to avoid excess refrigerant oil discharge with the refrigerant.

3. Disconnect the pressure switch electrical connector.
4. Switch from the A/C liquid line near the (RH) strut tower.

Install or Connect

1. Pressure switch to A/C liquid line.
2. Electrical connector to pressure switch.
3. Battery negative (-) cable.
4. Evacuate and charge refrigerant system. Refer to "Evacuating System" and "Charging Procedure" earlier in this section.

VACUUM SWITCHING VALVE (VSV)

Figures 29, 30 and 31

Remove or Disconnect

1. Battery negative (-) cable.
2. Two retaining clamps and vacuum hoses from vacuum switching valve.
3. Vacuum switching valve electrical connector.
4. Two attaching bolts from the vacuum switching valve mounting bracket and remove the valve.

Inspect

1. Check the vacuum switching valve for proper vacuum continuity using a 12V supply as shown in Figure 29.

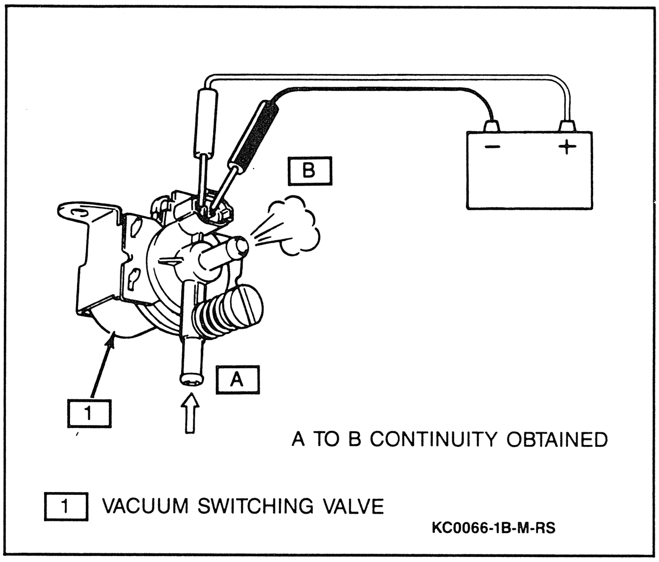

B
– +
A
1
A TO B CONTINUITY OBTAINED
1 VACUUM SWITCHING VALVE
KC0066-1B-M-RS

Figure 29 Vacuum Switching Valve Vacuum Continuity Check

2. Check the vacuum switching valve for short circuit condition using an ohmmeter. No continuity should exist between each terminal and the valve housing (Figure 30).

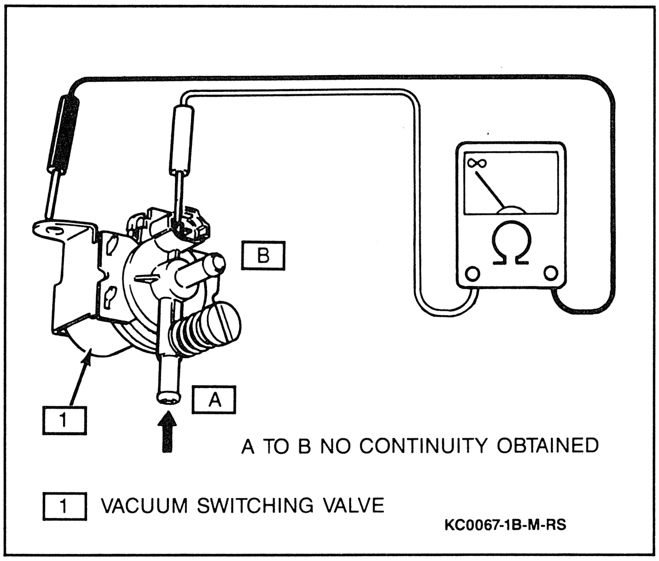

∞
Ω
B
A
1
A TO B NO CONTINUITY OBTAINED
1 VACUUM SWITCHING VALVE
KC0067-1B-M-RS

Figure 30 Vacuum Switching Valve Short Circuit Check

3. Check the vacuum switching valve for open circuit condition by measuring the resistance between terminals (Figure 31).
4. If any of the previous checks are not satisfactory, the vacuum switching valve must be replaced.

Install or Connect

1. Vacuum switching valve to mounting bracket and 2 attaching screws to vacuum switching valve.
2. Vacuum switching valve electrical connector.
3. Two vacuum hoses and retaining clamps to vacuum switching valve.
4. Battery negative (-) cable.

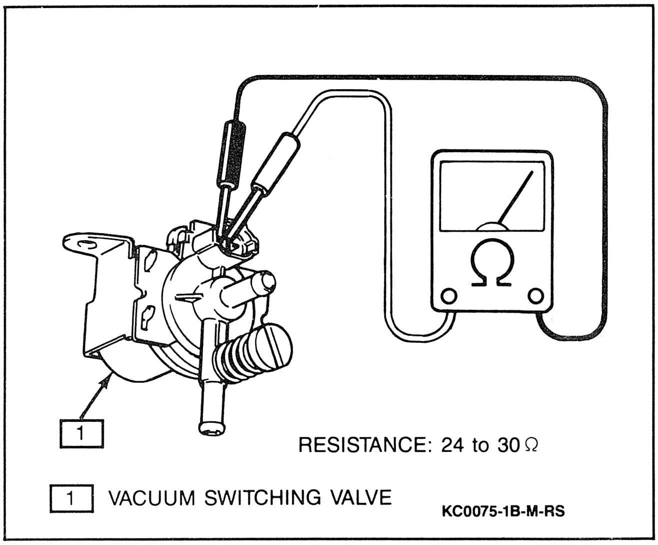


Figure 31 Vacuum Switching Valve Open Circuit Check

MAGNETIC CLUTCH

Inspect

1. Check the pressure plate and rotor for wear and oil soaked conditions respectively.
2. Check the clutch bearing for noise, wear and grease leakage.
3. Measure the stator coil for resistance. The resistance should be 3.2 ± 0.2 ohms at room temperature 25°C (77°F). If the measured resistance is not within the above tolerance, replace the coil.

CONDENSER FAN OR MAGNETIC CLUTCH RELAY

Figure 32

Remove or Disconnect

1. Battery negative (-) cable.
2. Relay electrical connector and remove from main fusebox.

Inspect

1. Check whether proper continuity can be obtained between the indicated relay wire terminals. If continuity does not exist, replace relay (Figure 32).

Install or Connect

1. Relay to main fusebox and relay electrical connector.
2. Battery negative (-) cable.

COMPRESSOR

Figure 33

Remove or Disconnect

1. Stop engine; battery negative (-) cable.

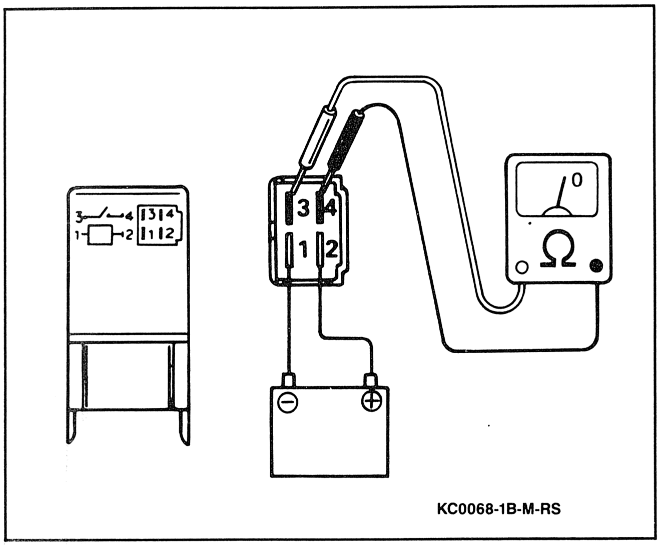


Figure 32 Condenser Fan or Magnetic Clutch Relay Continuity Check

2. Discharge and recover refrigerant from system. Refer to "Air Conditioning Refrigerant Recovery and Recycling (ACR^3) Station Set Up and Refrigerant Recovery" earlier in this section.

NOTICE: Care should be exercised during discharge to avoid excess refrigerant oil discharge with the refrigerant.

3. Clutch coil lead wire from A/C wire harness.
4. Suction and discharge flexible hoses from the joint service connector.
5. O-rings from joint service connector side of flexible hoses.

NOTICE: Cap the open fittings immediately to keep moisture and foreign material out of the system.

6. Hoist vehicle and remove (RH) fender extension and oil filter.
7. Loosen compressor drive belt and remove belt from compressor hub assembly.
8. Two compressor attaching bolts and 1 attaching nut from the compressor mount and remove compressor with clutch assembly from mount.

NOTICE: When removing compressor, exercise care not to damage fins of condenser.

Install or Connect

1. Compressor with magnetic clutch assembly to compressor mount, 2 attaching bolts and 1 attaching nut to mount.
2. Compressor drive belt to compressor hub assembly.

Tighten

- Tighten 12 mm compressor attaching bolts and nut to 28 N·m (21 lb.ft.).

Adjust

- Compressor drive belt tension (Figure 33).

3. RH fender extension and oil filter; lower vehicle.
4. O-rings to joint service connector side of flex hose.
5. Suction and discharge flexible hoses to joint service connector.
6. Clutch coil lead wire to A/C wire harness.
7. Battery negative (-) cable.
8. Evacuate and charge system. Refer to "Evacuating System" and "Charging Procedures" earlier in this section.

COMPRESSOR MOUNT

Remove or Disconnect

1. Compressor.
2. Four compressor mount attaching bolts and mount from engine block.

Inspect

- Mount for cracks and for fractures. Replace as necessary.

Install or Connect

1. Compressor mount to engine block and 4 compressor mounting bolts.

Tighten

- Tighten 12 mm compressor mount attaching bolts to 28 N·m (21 lb.ft.).
- Tighten 14 mm compressor mount attaching bolts to 45 N·m (33 lb.ft.).

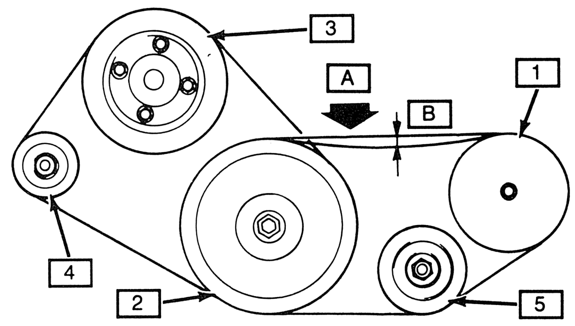
2. Compressor (See procedure in this section).
3. Evacuate and charge refrigerant system. Refer to "Evacuating System" and "Charging Procedure" earlier in this section.

COMPRESSOR DRIVE BELT

Figure 33

Inspect

1. Belt tension; adjust if necessary (Figure 33).
2. Belt for wear and cracks; replace as necessary.



A 10 KG (22 LB) THUMB PRESSURE
B DEFLECTION: 5-6.5mm (0.20-0.25 IN.)
1 MAGNETIC CLUTCH PULLEY
2 CHANKSHAFT PULLEY
3 WATER PUMP PULLEY
4 ALTERNATOR PULLEY
5 IDLE PULLEY

KC0069-1B-M-RS

Figure 33 Belt and Pulley Diagram

PERFORMANCE TEST

After finishing all repairs, make sure to carry out the performance test of the air conditioning system as follows:

1. Connect the high and low side charging hose of manifold gage set to the service valves.
2. Run the engine and keep the engine speed at 2, 000 rpm.
3. Operate the air conditioner and set the blower switch at "HI" and the temperature lever at "COOL."
4. Keep all the windows and doors open.
5. Insert a dry bulb thermometer in the cool air outlet and place the psychrometer (dry and wet bulb thermometer) close to the inlet of evaporator (Figure 34).
6. The high pressure gage reading should be within the specified pressure range, 14.0 - 15.5 kg/cm^2 (200 - 200 psi).
7. The dry bulb thermometer at the air inlet should be within 25 - 35°C (77 - 95°F). Under the above conditions, operate the air conditioning system until a stabilized condition on high and low pressure gages and the thermometers have been established.

How To Read The Standard Performance Curve

1. Read the psychrometer at the inlet and obtain the relative humidity from psychrometeric chart (Figures 36 and 37).
2. Measure the dry bulb temperature at the cool air outlet, then find out the difference between the inlet and outlet temperature (Figures 36 and 37).
3. Check the relative humidity-to-temperature difference relationship using Figure 35 as an example of 17°C (62.6°F) temperature difference and 60% relative humidity. The intersection point of these measurements fall within the shaded area between the 2 lines. Therefore, cooling performance can be considered satisfactory.

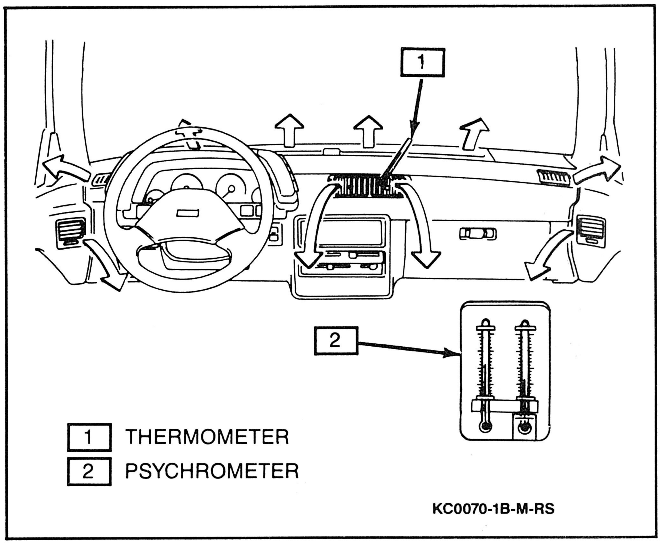


Figure 34 Checking Relative Humidity

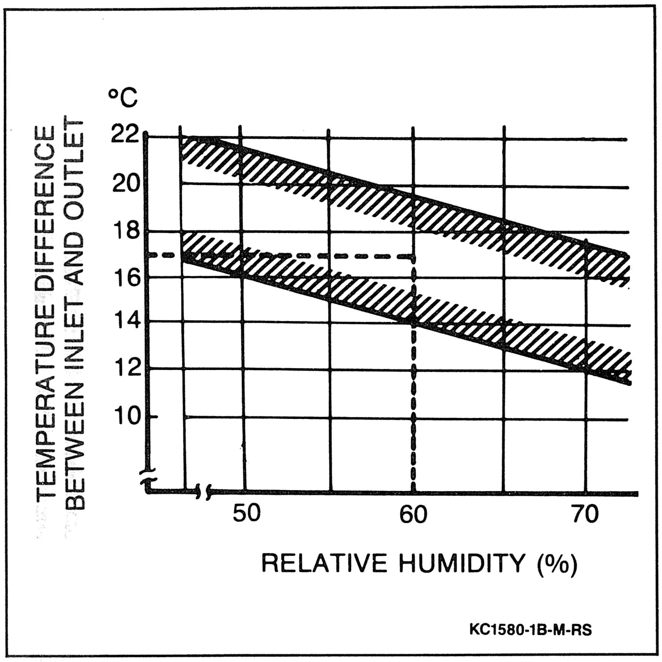


Figure 35 Temperature Humidity Relationship Chart

HOW TO READ RELATIVE HUMIDITY (°F)

Measure wet-bulb temperature and dry-bulb temperature on the psychrometer at the evaporator air inlet, follow lines at those temperatures and read the relative humidity curve at their intersection.

Example:

If dry-bulb temperature is 90°F and wet-bulb temperature is 78°F, the relative humidity is 60%.

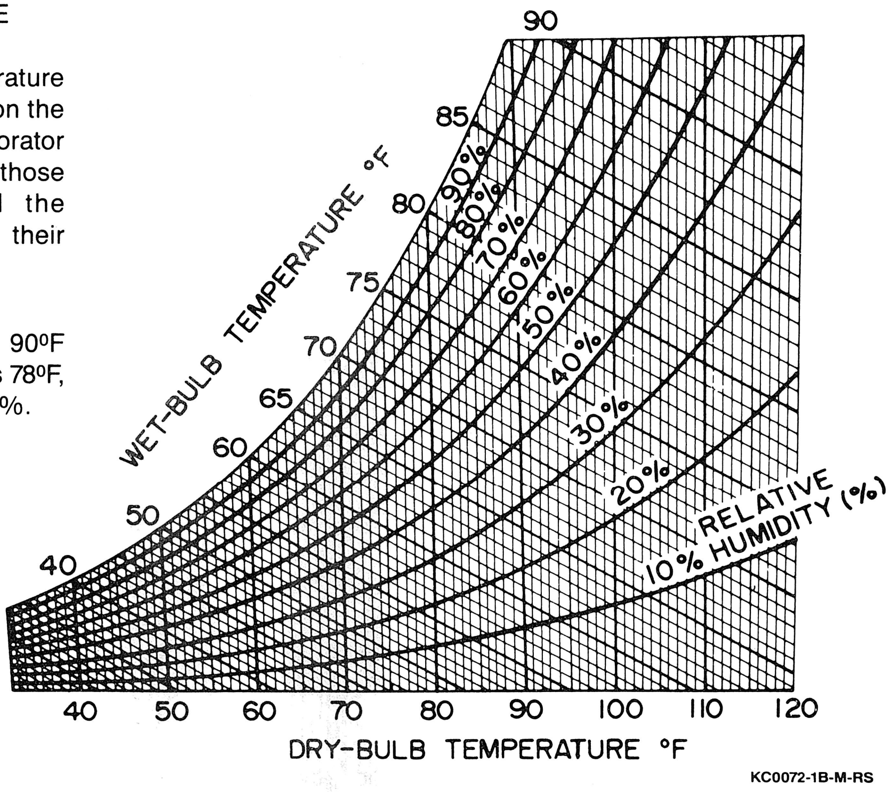


Figure 36 Temperature (°F) Vs. Humidity Chart

HOW TO READ RELATIVE HUMIDITY (°C)

Measure wet-bulb temperature and dry-bulb temperature on the psychrometer at the evaporator air inlet, follow lines at those temperatures and read the relative humidity curve at their intersection.

Example:

If dry-bulb temperature is 25°C and wet-bulb temperature is 19.5°C, the relative humidity is 60%.

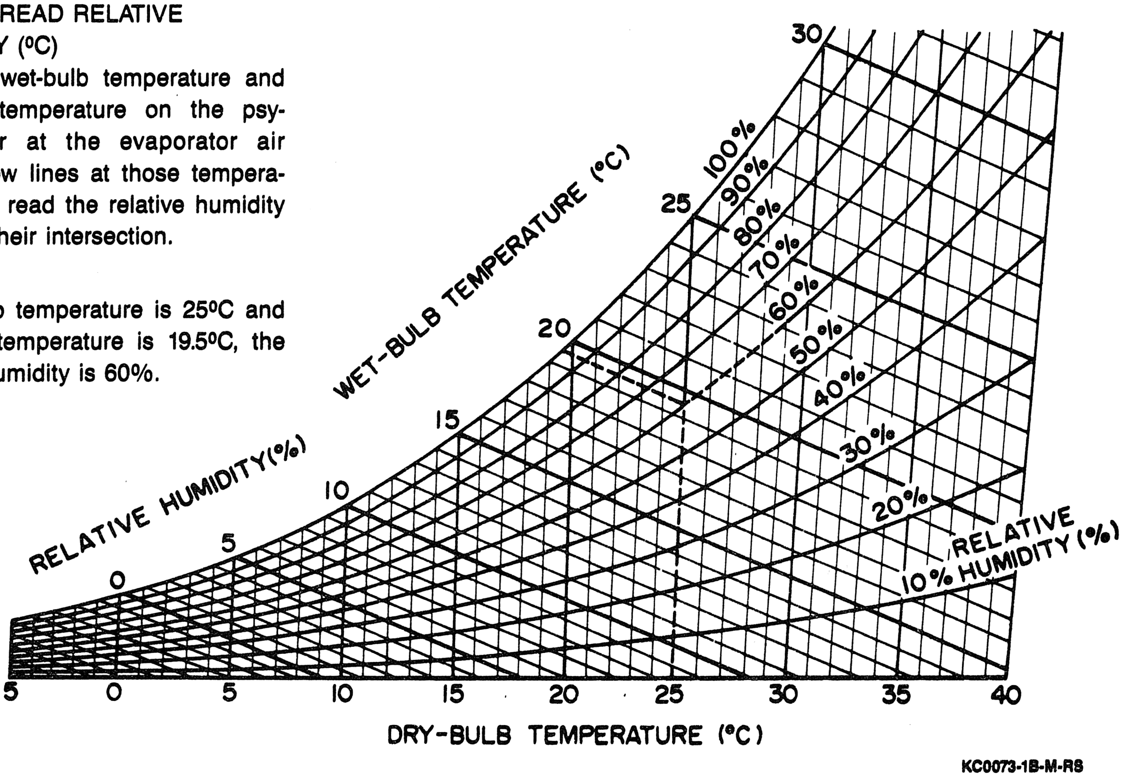
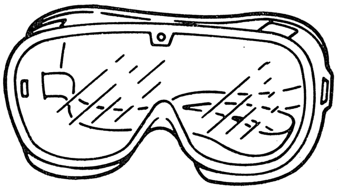


Figure 37 Temperature (°C) Vs. Humidity Chart

SPECIAL TOOLS

1

J 5453



2

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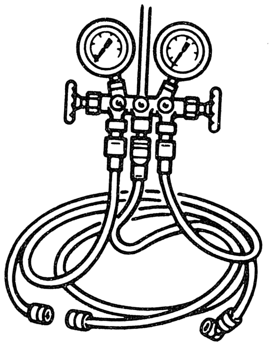

3

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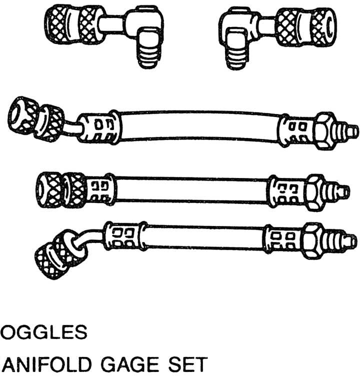

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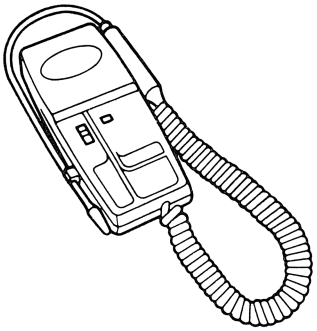

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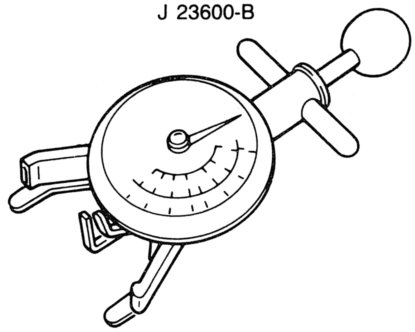

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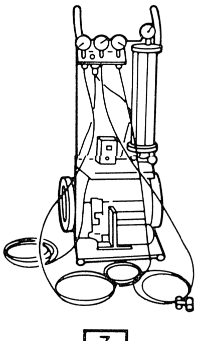
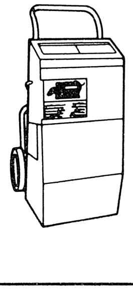


7

J 38100-B



1	GOGGLES
2	MANIFOLD GAGE SET
3	HOSE ADAPTER KIT
4	ELECTRONIC LEAK DETECTOR
5	BELT TENSIONING GAGE
6	A/C CHARGING STATION
7	A/C REFRIGERANT RECOVERY AND RECYCLING STATION (ACR^3)

LC9000-1B-M-RS

SECTION 1D

AIR CONDITIONER COMPRESSOR OVERHAUL

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GENERAL INFORMATION

When servicing the compressor, keep dirt or foreign material from getting on or into the compressor parts and system. Clean tools and a clean work area are important for proper service. The compressor connections and the outside of the compressor should be cleaned before any "On-Vehicle" repair, or before removal of the compressor. The parts must be kept clean at all times and any parts to be reassembled should be cleaned with Trichloroethane, naphtha, kerosene or equivalent solvent and dried with dry air. Use only lint free cloths to wipe parts.

The operations described below are based on bench overhaul with compressor removed from the car, except as noted. They have been prepared in order of accessibility of the components. When compressor is removed from the car for servicing, the oil remaining in the compressor should be discarded and new refrigerant oil added to the compressor.

Minor repair procedures may be done on the car without discharging the system. Major repair procedures require that the system be discharged of refrigerant.

TROUBLE DIAGNOSIS

Compressor troubles can be roughly differentiated into gas leakage, noise and insufficient pressure. Compressor gas leakages are in most cases those that develop from the shaft seal. When detecting gas leakage, always use a leak tester. If a small amount of oil seeps out from the shaft seal, there is no necessity of replacing the seal. The shaft seal has been designed to allow a small amount of oil to leak out for lubricating purpose. Thus, the shaft seal should be replaced only when a large amount of compressor oil is leaking out or when gas leakage is discovered by use of gas tester. In regard to noise and insufficient pressure, repairs should be made only after performing correct diagnosis of the trouble.

ITEM	PROBLEM	POSSIBLE CAUSES	CORRECTION
1	Noise from compressor	1. Defective piston shoe 2. Defective bearing 3. Defective cylinder and/or shaft	Replace Replace Replace
2	Noise from magnetic clutch	1. Defective bearing 2. Defective clutch	Replace Replace
3	Insufficient cooling	1. Defective gasket 2. Defective reed valve	Replace Replace

4	Not rotating	1. Locked by item 1-1 to 1-3 and 3-2. 2. Seized magnetic clutch 3. Rotating parts seized due to insufficient oil	Replace Replace or repair Replace or repair
5	Oil and/or gas leakage	1. Defective seal 2. Defective O-ring	Replace Replace

ON CAR INSPECTION

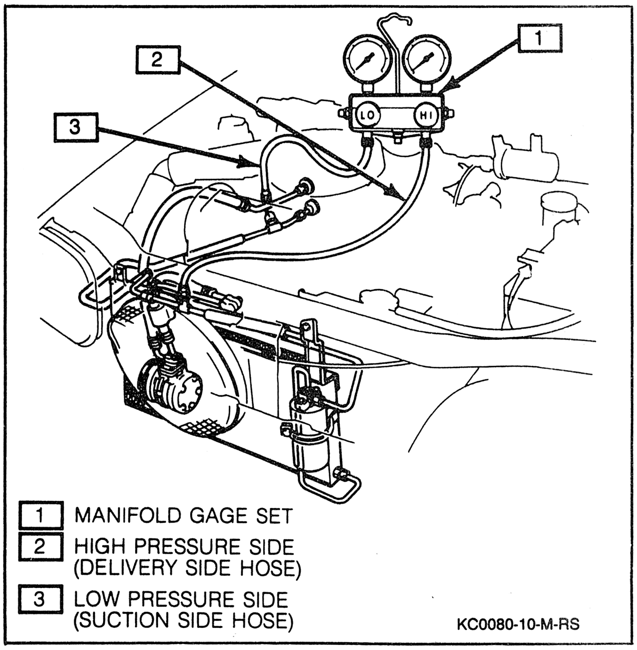

1
2
3
LO
HI
1 MANIFOLD GAGE SET
2 HIGH PRESSURE SIDE (DELIVERY SIDE HOSE)
3 LOW PRESSURE SIDE (SUCTION SIDE HOSE)
KC0080-10-M-RS

Figure 1 Manifold Gage Set

1. Install manifold gage set as shown in Figure 1D-1.
2. Close Hi and Low hand valves.
3. Run engine at fast idle.
4. Check compressor for following:
   a. High pressure gage reading is not low and low pressure gage reading is not higher than normal.

      NOTICE: If the low pressure side reads too high or the high pressure side too low, the probable cause is leakage from the reed valve inside the compressor or a broken sliding part (piston, cylinder, or others). In such a case, disassembly of the compressor will be necessary.

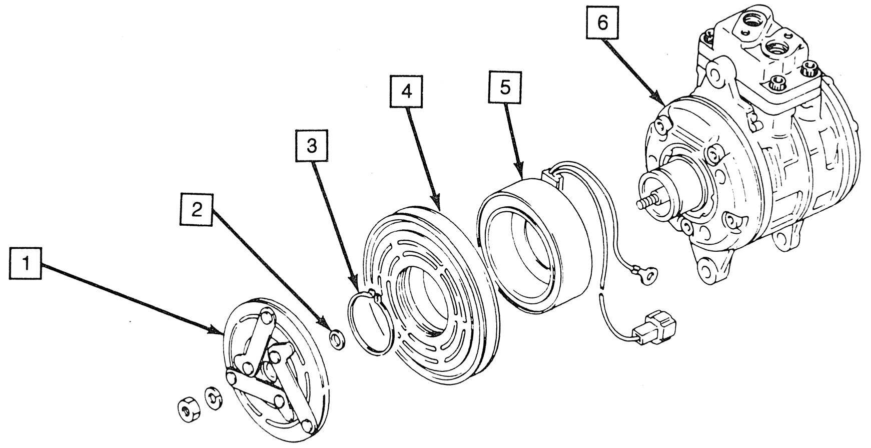
   b. Metallic sound.
   c. Leakage from shaft seal.

   If any of the above checks indicate a defect, repair the compressor.
5. Check magnetic clutch.
   a. Inspect the pressure plate and the rotor for signs of oil.
   b. Check the clutch bearings for noise and grease leakage.
   c. Using an ohmmeter, measure the resistance of the stator coil between the clutch lead wire and ground at 25 °C (77 °F). If the resistance is not within tolerance, replace the coil.
   d. The standard resistance has a valve of 3.2± 0.2 ohms.

Removal Of Compressor

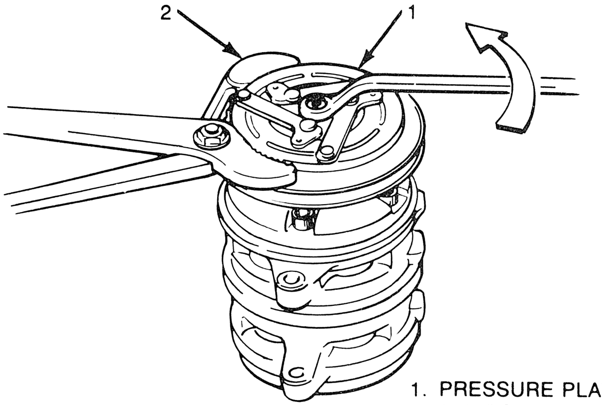
NOTICE: For removal and installation procedures, (SEE SECTION 1B).

DISASSEMBLY OF MAGNETIC CLUTCH



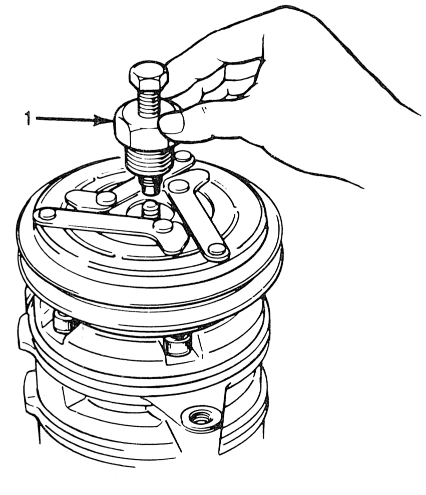
1. PRESSURE PLATE
2. SHIM
3. SNAP RING
4. DRIVE CLUTCH
5. MAGNETIC CLUTCH COIL
6. COMPRESSOR

1. Remove pressure plate nut.



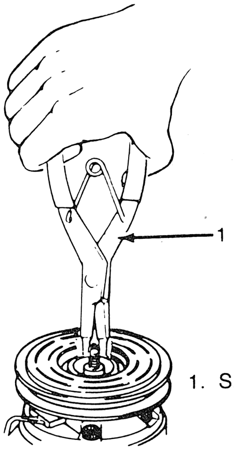
1. PRESSURE PLATE
2. PLIERS

2. Using a pressure plate remover, remove the pressure plate.



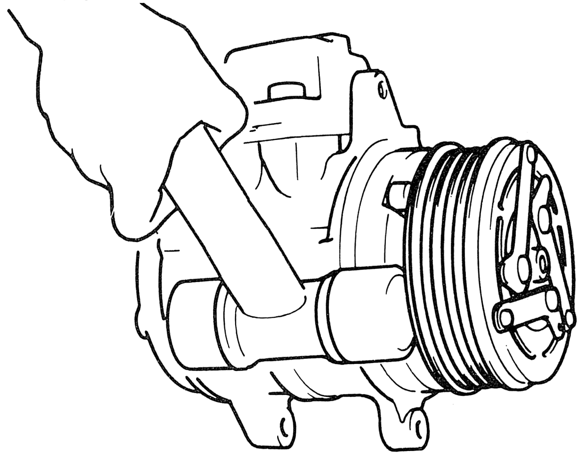
1. SPECIAL TOOL J 34878

3. Remove the shims from the shaft.
4. Remove drive clutch.
   Using snap ring pliers, remove the snap ring.



1. SNAP RING PLIERS

5. Using plastic hammer, tap the drive clutch off the shaft.

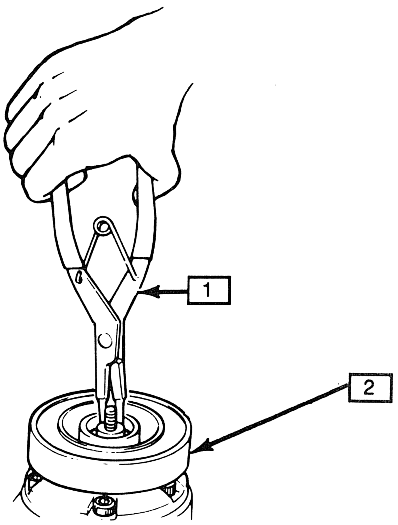


NOTICE: Care should be exercised not to damage pulley when tapping off.

KC0085-1D-M-RS

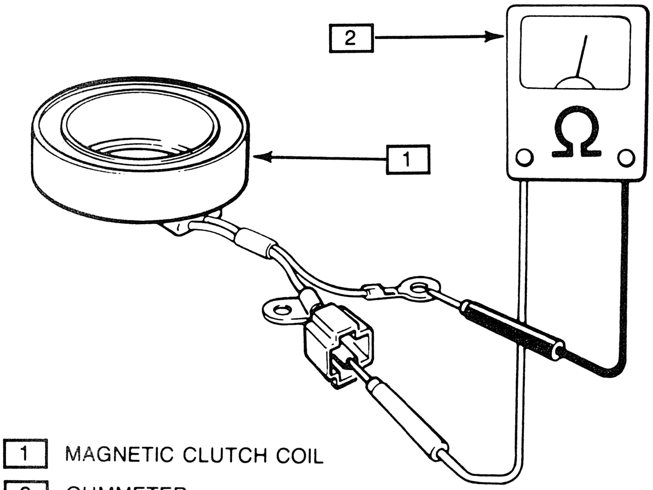
Figure 2 Disassembly of Magnetic Clutch - A

6. Remove clutch coil.
   Disconnect the coil lead wire from the compressor housing using snap ring pliers, remove the snap ring.


1
2
1 SNAP RING PLIERS
2 MAGNETIC CLUTCH COIL

7. Inspect pressure plate, drive clutch and clutch coil.
   a. Inspect the pressure plate and drive clutch surface for wear and scoring. Replace if necessary.
   b. Check the drive clutch bearings for wear and leakage of grease. Replace if necessary.
   c. Check the clutch coil for resistance using ohmmeter. Replace if necessary.

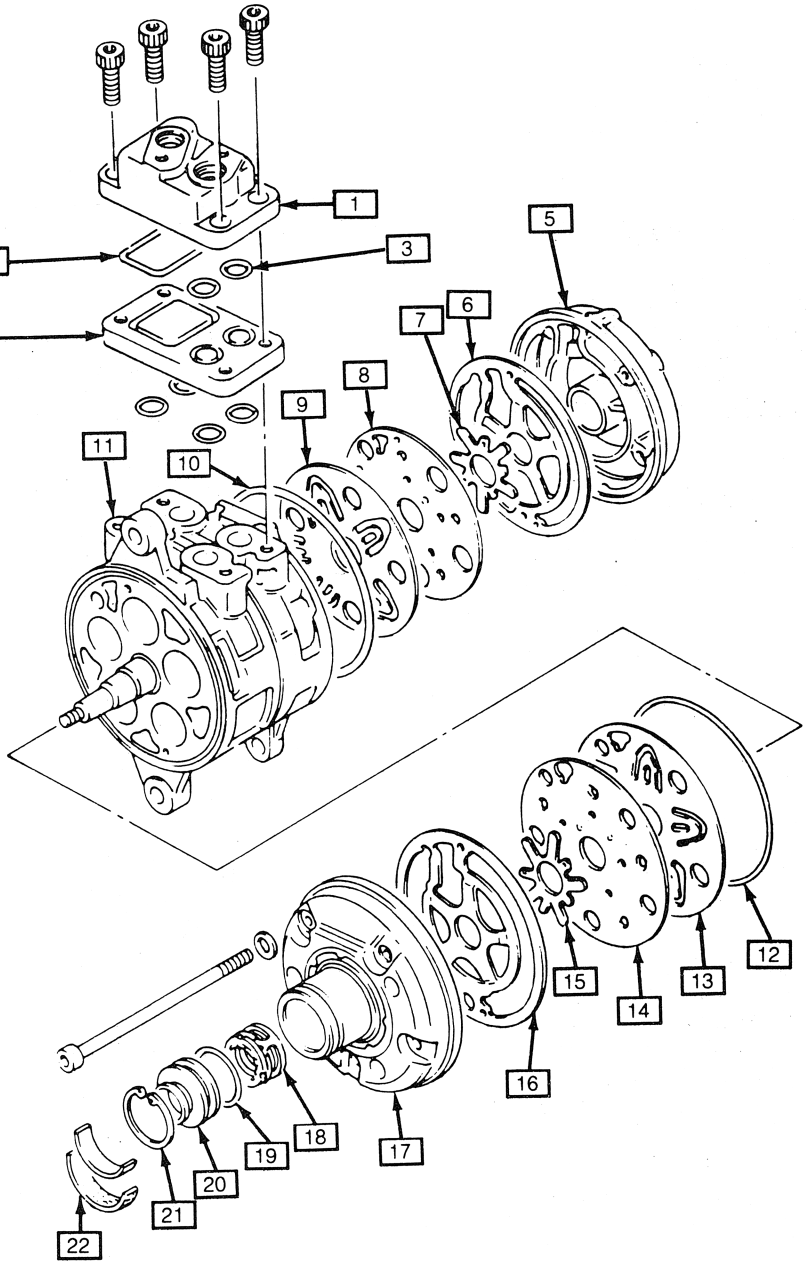
Standard resistance	3.2 ± 0.2Ω


2
Ω
1
1 MAGNETIC CLUTCH COIL
2 OHMMETER

KC0086-10-M-RS

Figure 3 Disassembly of Magnetic Clutch - B

DISASSEMBLY OF COMPRESSOR

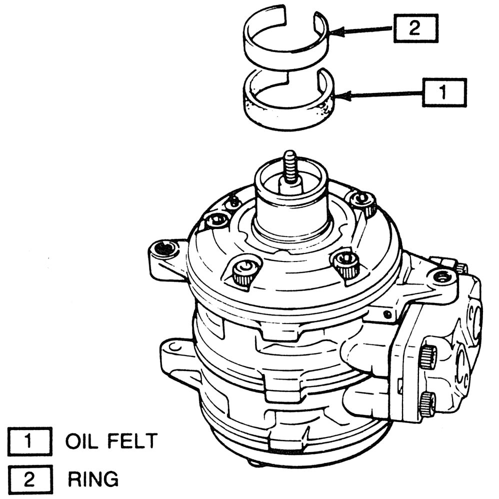


1	JOINT SERVICE CONNECTOR
2	DIFFUSER SEAL
3	O-RING
4	DIFFUSER
5	REAR HOUSING
6	REAR GASKET
7	REED VALVE
8	VALVE REAR PLATE
9	SUCTION VALVE
10	CYLINDER SEAL
11	COMPRESSOR CYLINDER
12	CYLINDER SEAL
13	SUCTION VALVE
14	VALVE FRONT PLATE
15	REED VALVE
16	FRONT GASKET
17	CYLINDER FRONT HEAD
18	SHAFT SEAL
19	O-RING
20	SEAL PLATE
21	SNAP RING
22	OIL FELT

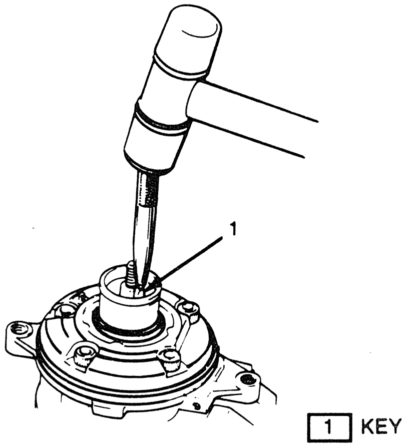
KC0124-1D-M-RS

Figure 4 Compressor Disassembly - A

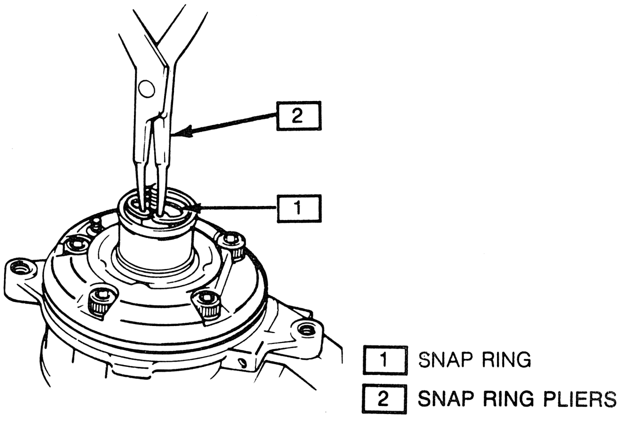
1. Remove oil felt.
   Using a screw driver, pry out the oil felt.


2
1
1 OIL FELT
2 RING

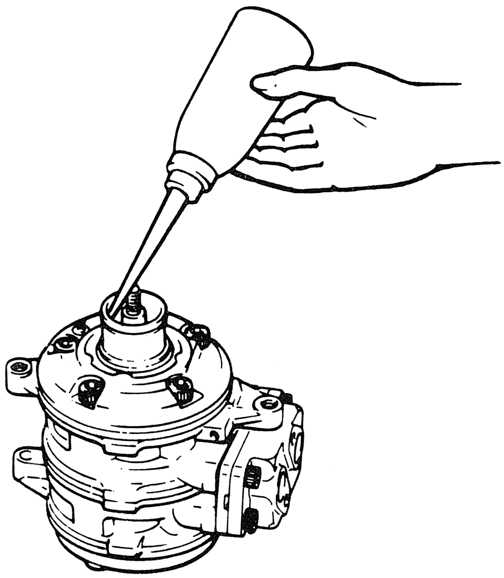
2. Using a hammer and punch, drive the key from the shaft.



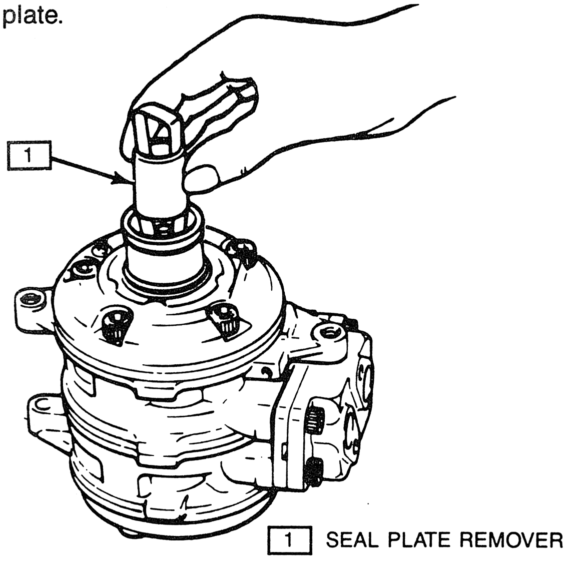
3. Using snap ring pliers, remove the snap ring.


2
1
1 SNAP RING
2 SNAP RING PLIERS

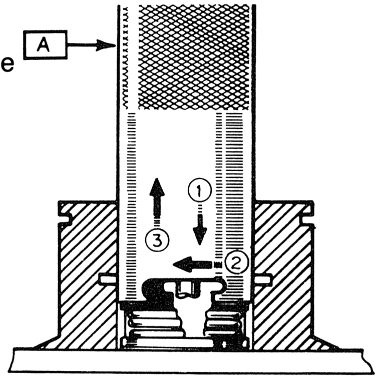
4. Apply compressor oil to inner bore.



5. Using seal plate remove J 9393-A remove the seal plate.


1
1 SEAL PLATE REMOVER

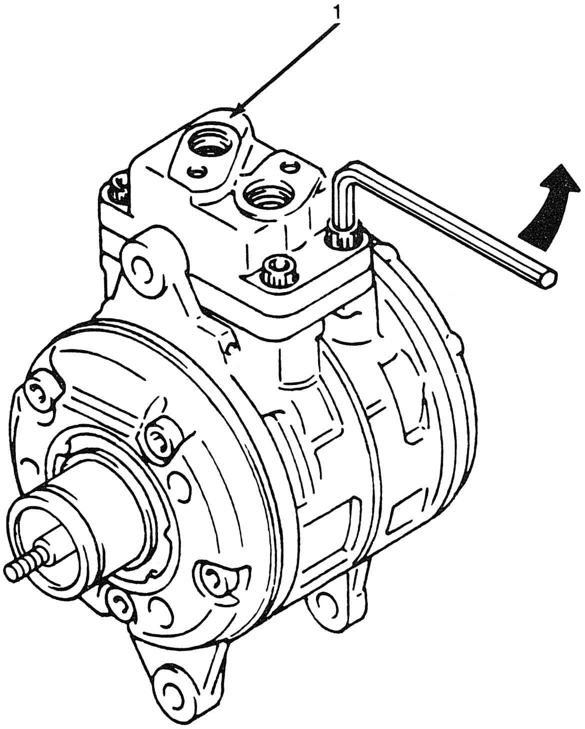
6. Using shaft seal remove J 34879 remove the shaft seal.
   A. Shaft seal remover J 34879
   1. Push
   2. Turn
   3. Remove



KC0125-1D-M-RS

Figure 5 Compressor Disassembly - B

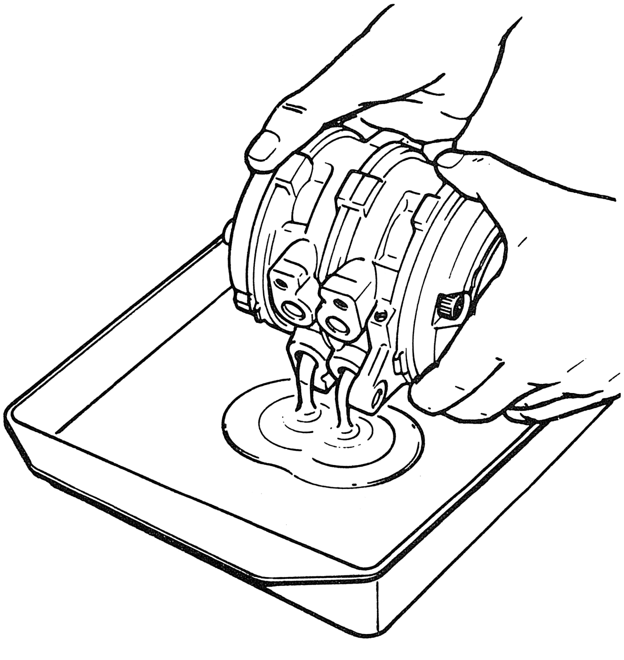
7. Remove two service valves (suction and discharge valves).



1. SERVICE VALVES

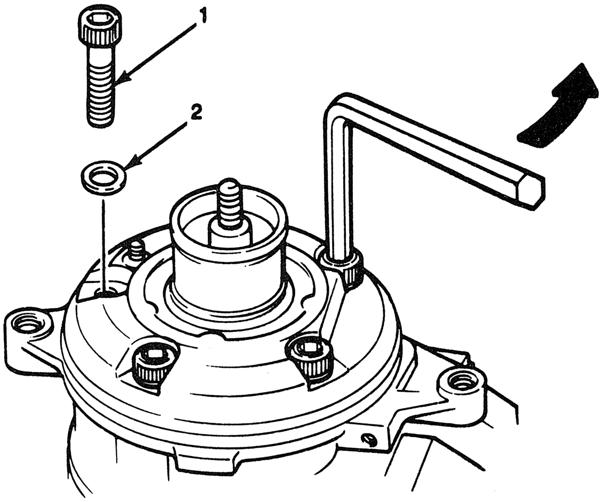
Remove the O-rings from the service valve and discard them.

8. Drain oil into container.



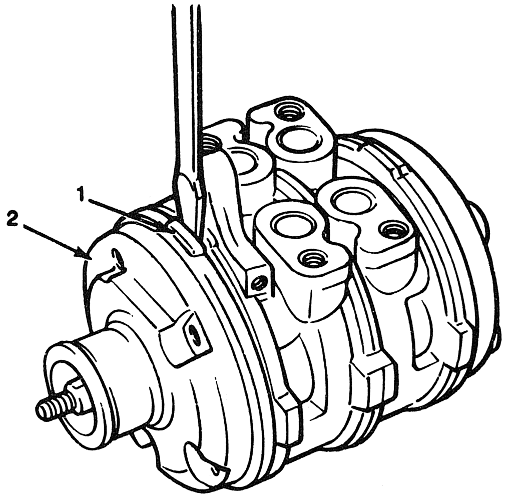
9. Remove front housing.

NOTICE: Do not reuse five washers.



1. BOLT
2. WASHER

10. Remove the front housing by prying at protrusion.



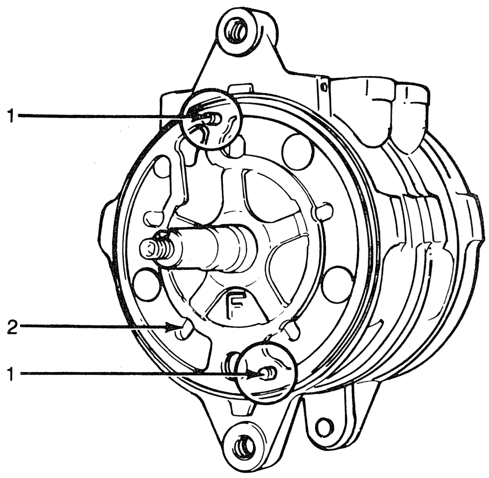
1. PROTRUSION
2. FRONT HOUSING

KC0126-1D-M-RS

Figure 6 Compressor Disassembly - C

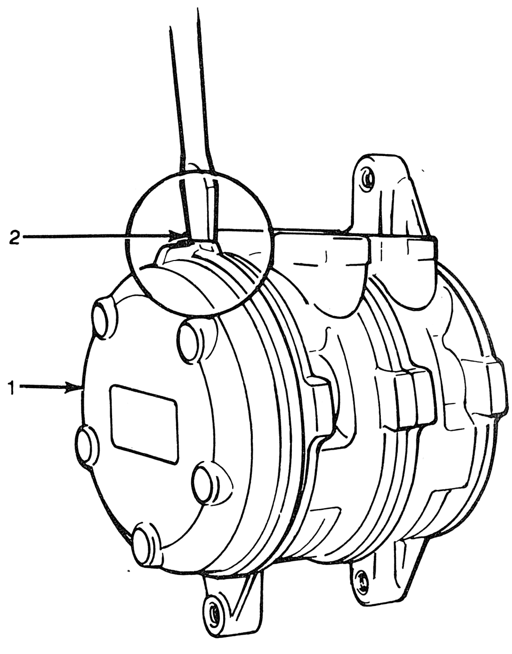
NOTICE:
Be careful not to scratch the sealing surface of the front housing.

11. Remove front valve plate.
    Remove two pins from the cylinder block.



1. PIN
2. VALVE PLATE

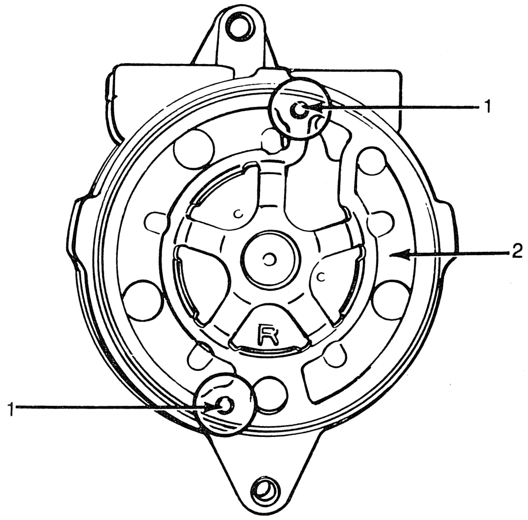
12. Remove the rear housing by prying at protrusion.



1. REAR HOUSING
2. PROTRUSION

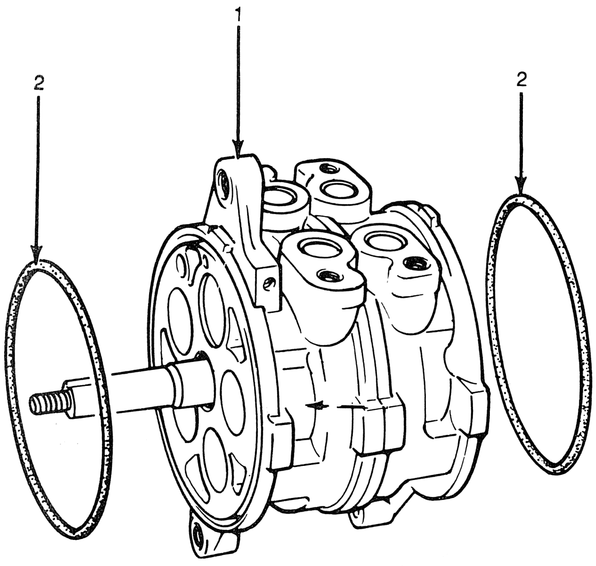
NOTICE:
Be careful not to scratch the sealing surface of the rear housing.

13. Remove rear valve plate.
    Remove two pins from the rear housing.



1. PIN
2. VALVE PLATE

14. Remove front and rear O-rings from the cylinder block. Discard the O-rings.



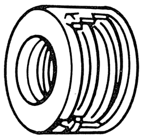
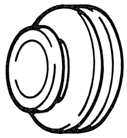
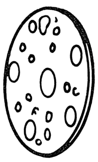
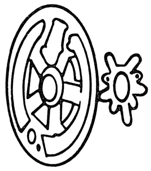
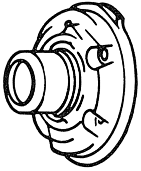
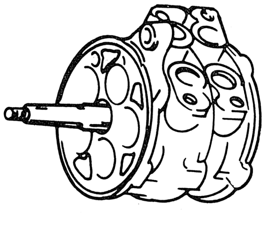
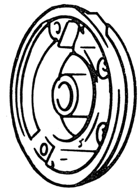
1. CYLINDER BLOCK
2. O-RINGS

KC0127-1D-M-RS

Figure 7 Compressor Disassembly - D

CHECKING COMPONENTS

Clean all parts with cleaning solvent and apply compressor oil on the parts.

PARTS NAME	CHECK POINT	REMEDY
Shaft seal 	1. Check the lapping surface of carbon disc for cracks and scratches. 2. Check the rubber seal for cracks and hardening. 3. Check the spring action.	Replace Replace Replace
Seal plate 	1. Check the sealing surfaces for scratches and corrosion.	Replace
Valve plate 	1. Check both surfaces for scratches and corrosion.	Replace or polish with fine oil stone.
Reed valve 	1. Check the reed for cracks, scratches, deformation and corrosion.	Replace
Front housing 	1. Check the sealing surface for cracks, scratches and deformation.	Replace
Piston/Cylinder block 	1. Check the cylinder bore for scratches and corrosion. 2. Check the radial bearings for poor contact, worn-out needle, scoring or pit. 3. Check the shaft for excessive axial play. 4. Check the piston for excessive axial play.	Replace Replace Replace Replace
Rear housing 	1. Check the sealing surface for cracks, scratches and deformation.	Replace

KC0128-1D-M-RS

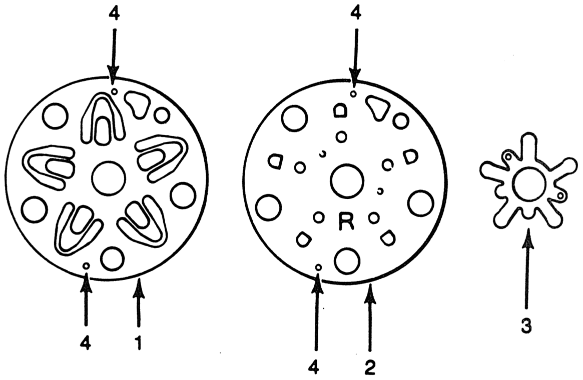
Figure 8 Diagnostic Chart

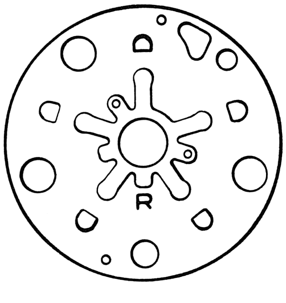
ASSEMBLY OF COMPRESSOR

NOTICE:

- Do not re-use gasket shift seal, O-rings, washers. Use overhaul gasket kit.
- Before starting the assembly, make sure all parts and work-bench are clean.

1. Install rear valve plate on rear cylinder.
a. Install two pins in the rear cylinder.
b. Lubricate new O-ring with compressor oil. Install the O-ring in the rear cylinder.
c. Install the suction reed valve, rear valve plate, and discharge reed valve on to rear cylinder top. For the installation locations, refer to the following drawing.

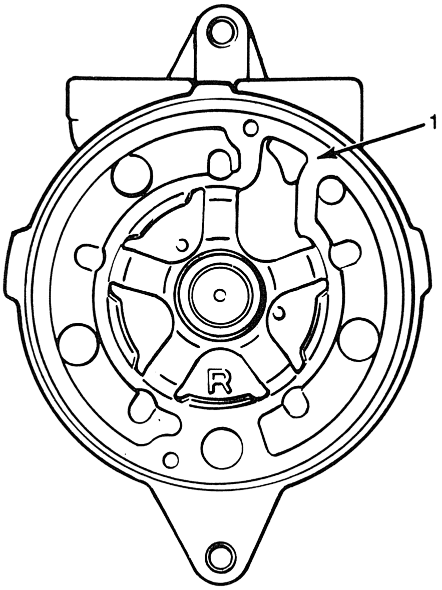




1. SUCTION REED VALVE
2. REAR VALVE PLATE
3. DISCHARGE REED VALVE
4. PIN HOLES

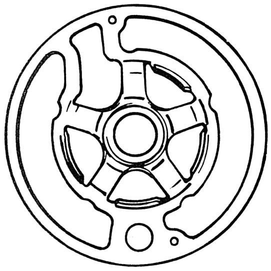
NOTICE:
Front and rear reed valves (suction and discharge) are the same.
Rear valve plate is marked "R".

d. Lubricate gasket with compressor oil. Install the gasket on the valve plate.

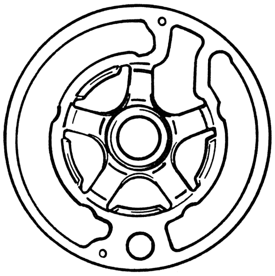


1. GASKET

NOTICE:
Front and rear gaskets are different, do not interchange them.



FRONT GASKET



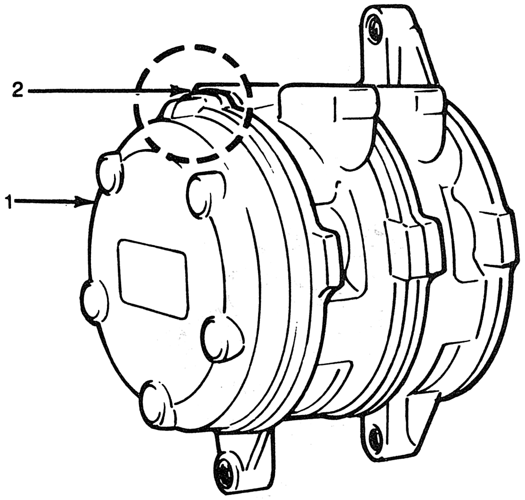
REAR GASKET

NOTICE:
Gaskets must be assembled so that the protruded surfaces face upward.

KC0129-1D-M-RS

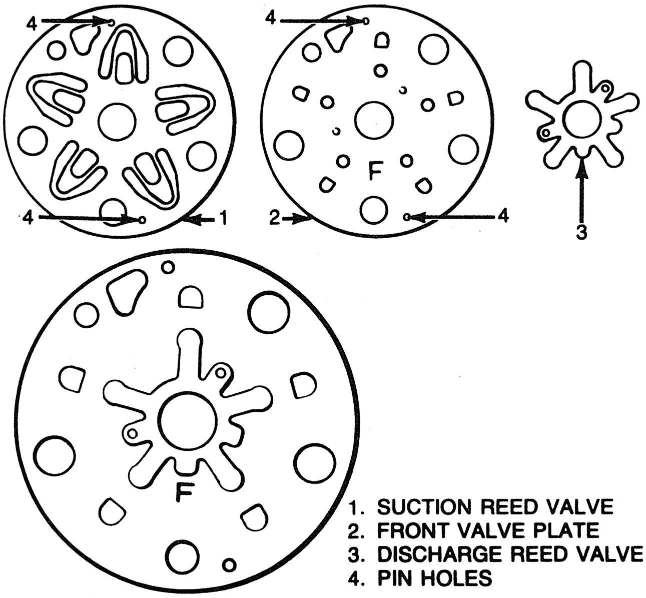
Figure 9 Compressor Assembly - A

2. Install rear housing on rear cylinder.
   The housing protrusion is positioned at the top side.



1. REAR HOUSING
2. PROTRUSION

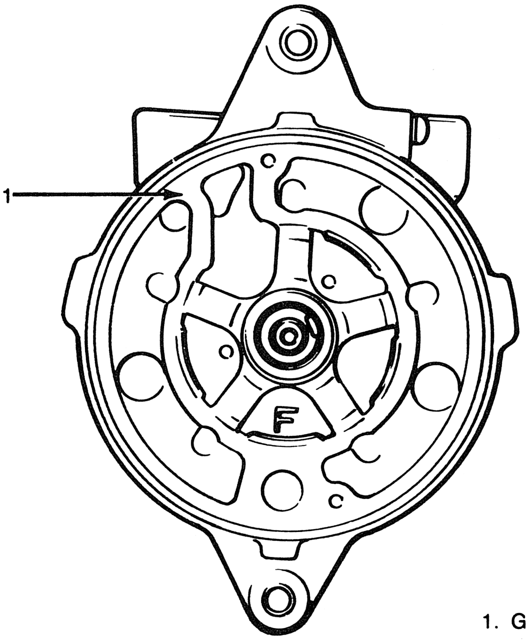
3. Install front valve plate on front cylinder.
   a. Install two pins in the front cylinder
   b. Lubricate new O-ring with compresor oil. Install the O-ring in the front cylinder.
   c. Install the suction reed valve, front valve plate, and discharge reed valve onto front cylinder top.
      For the installation locations, refer to the following drawing.



1. SUCTION REED VALVE
2. FRONT VALVE PLATE
3. DISCHARGE REED VALVE
4. PIN HOLES

NOTICE:
- Front and rear reed valves (suction and discharge) are the same.
- Front valve plate is marked "F".

d. Lubricate gasket with compressor oil. Install the gasket on the valve plate.



1. GASKET

NOTICE:
- Front and rear gaskets are different so do not interchange them. (To differentiate them, refer to the clause on rear valve plate.)
- Assemble the gaskets such that their protruded surfaces face upward.

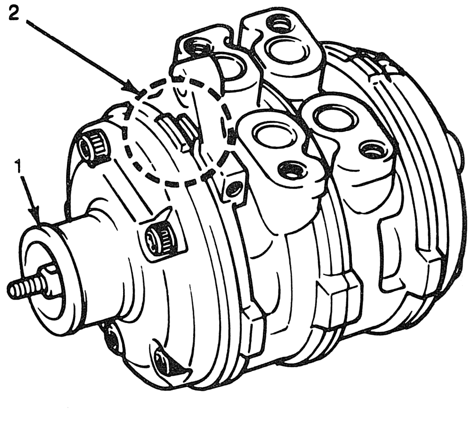
4. Install front housing on front cylinder and tighten five through bolts.
   a. Using a torque wrench and hexagon wrench, gradually tighten five through bolts.

Tightening torque	
26 N·m	19 lb. ft.

KC0130-1D-M-RS

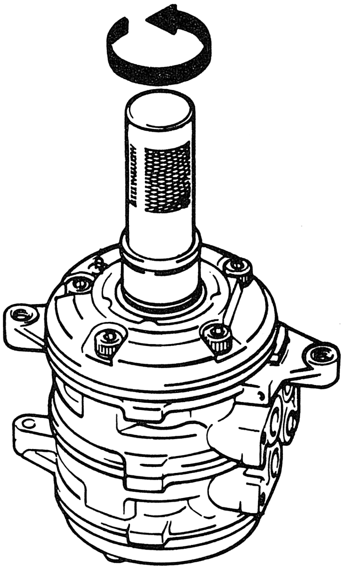
Figure 10 Compressor Assembly - B

NOTICE:
The housing protrusion should be positioned at the top side.

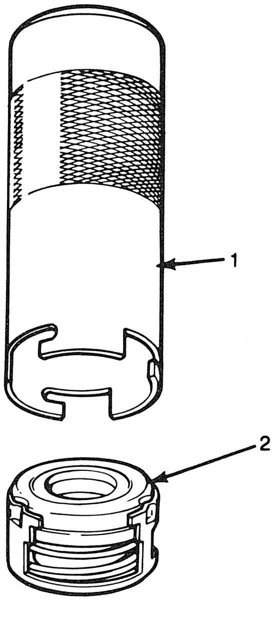


1. FRONT HOUSING
2. PROTRUSION

b. Apply oil to the bore.
Insert shaft seal remover and turn it to the left while lightly pressing.
Then pull up shaft seal remover.

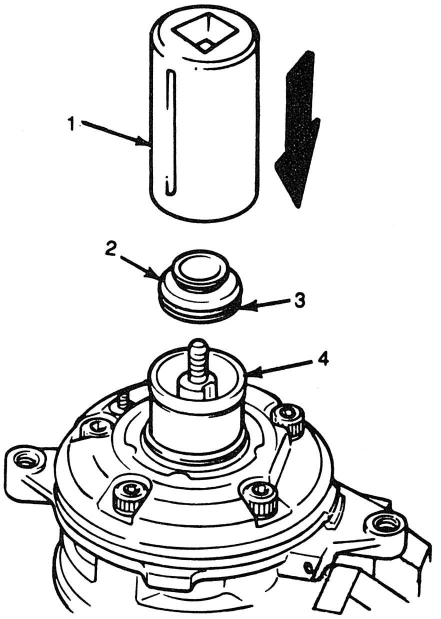


5. Install shaft seal.
   a. Lubricate the shaft seal with compressor oil and fit it to shaft seal remover J 34879.



1. SHAFT SEAL REMOVER (SPECIAL TOOL)
2. SHAFT SEAL

6. Install seal plate.
   a. Lubricate the O-ring with compressor oil. Put the seal plate.
   b. Press seal plate with socket by hand.

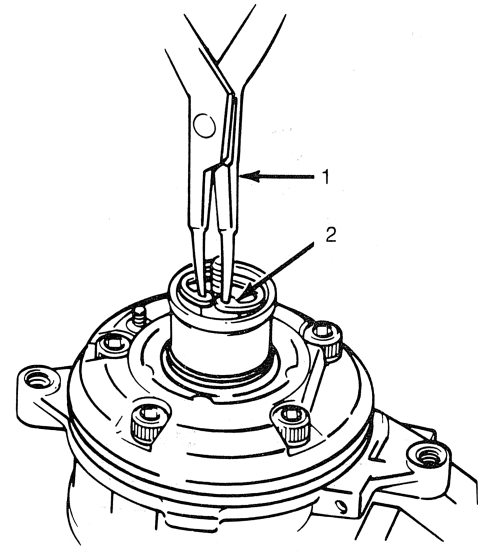


1. SOCKET
2. SEAL PLATE
3. O-RING
4. FRONT HOUSING

KC0131-1D-M-RS

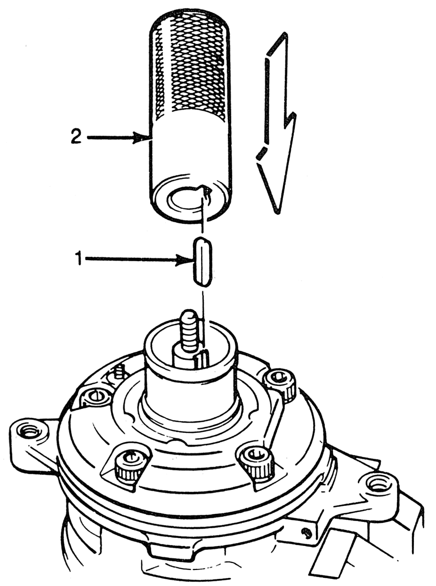
Figure 11 Compressor Assembly - C

7. Install snap ring.



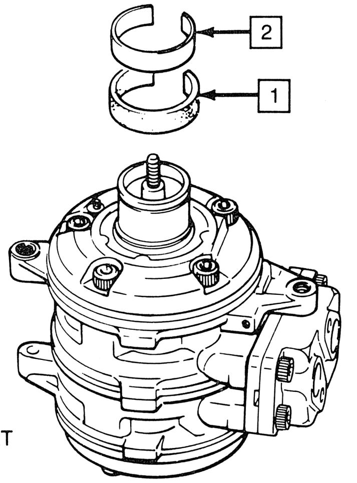
1. SNAP RING PLIERS
2. SNAP RING

8. Install key in shaft groove.
a. Using a plastic hammer and key installing tool J 34880 tip the key lightly



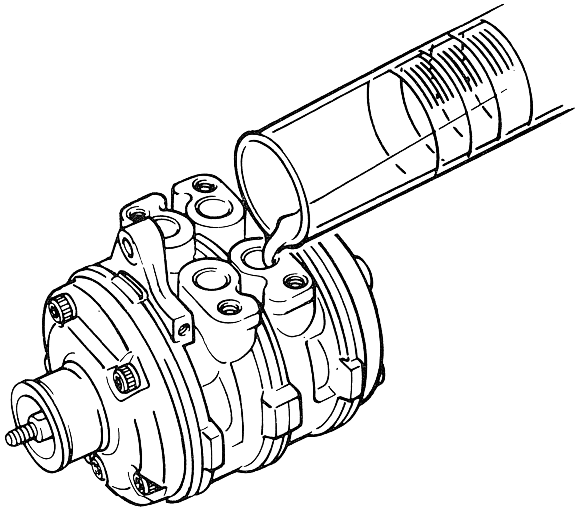
1. KEY
2. KEY INSTALLING TOOL J 34880

9. Install oil felt.
a. Put the new oil felt inside the bore.



1. OIL FELT
2. RING

10. Pour compressor oil into compressor.



Compressor oil capacity (When compressor is overhauled and reassembled)	40 cc (2.4 cu. in.)
Oil capacity of air conditioner system	80 ± 20 cc (4.9 ± 0.1 cu. in.)

NOTICE:
1. Approximately 40 cc (2.4 cu. in.) of compressor oil remains in the A/C system (evaporator, condensor, receiver/dryer, hoses and pipes), after compressor overhaul.
2. When replacing the compressor with a new one, drain 40 cc (2.4 cu. in.) of compressor oil from the new compressor, because it contains approx. 80 cc (2.8 cu. in.) of compressor oil.

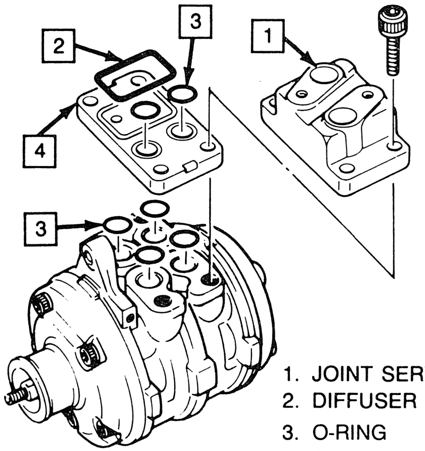
KC0132-1D-M-RS

Figure 12 Compressor Assembly - D

ASSEMBLY OF MAGNETIC CLUTCH

11. Install service valves.
    a. Lubricate new O-rings with compressor oil. Install the O-rings in the service valves.
    b. Install the service valve on the compressor.

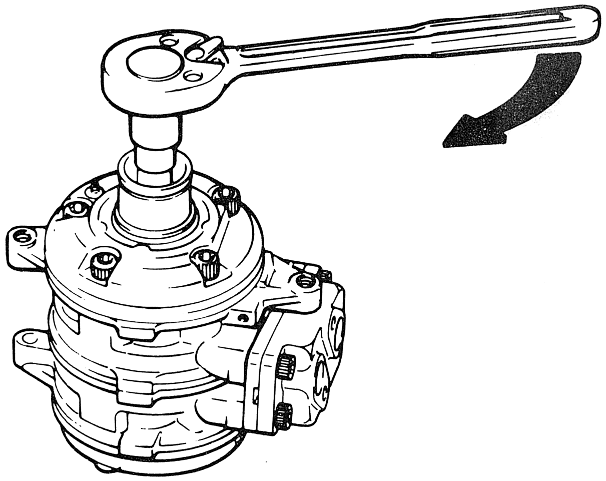
Tightening torque	
26 N·m	19 lb. ft.



1. JOINT SERVICE CONNECTOR
2. DIFFUSER SEAL
3. O-RING
4. DIFFUSER

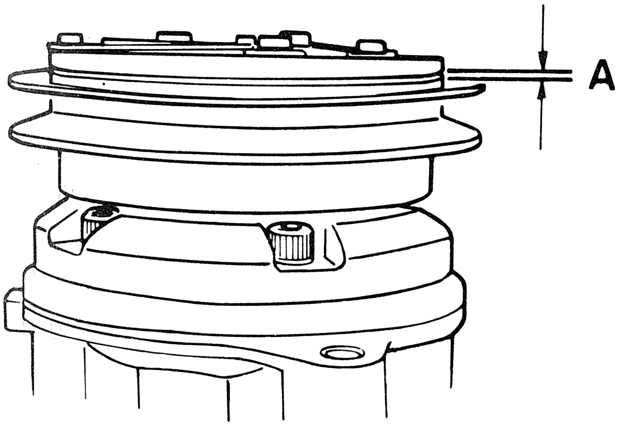
NOTICE:
Suction port has larger internal opening than discharge port.

12. Check shaft rotating torque.



Starting torque	less than 30 kg·cm (2.2 lb. ft.)

1. Install magnetic clutch coil.
   Install the clutch coil on the compressor.
2. Install drive clutch.
   a. Install the drive clutch on the compressor shaft.
   b. Using snap ring pliers, install the snap ring.
3. Install pressure plate.
   a. Adjust the clearance between the pressure plate and drive clutch by putting the shims on the compressor shaft.



A CLEARANCE
0.4 — 0.7 mm

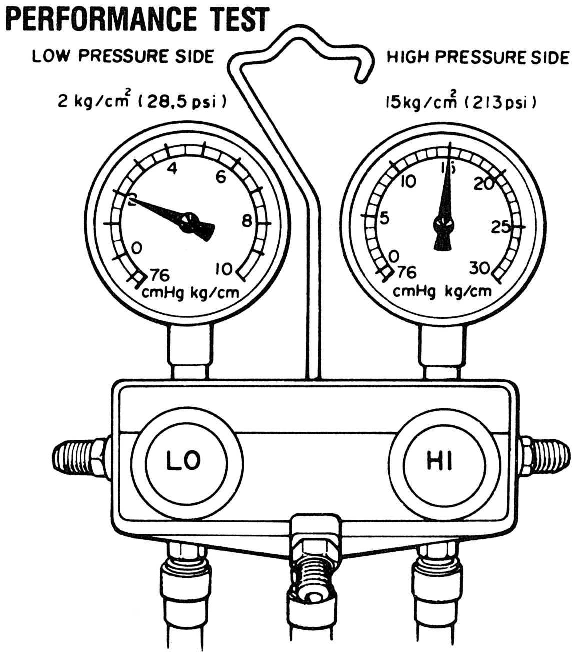
Standard clearance	0.4 — 0.7 mm (0.016-0.028 in)

b. Tighten the pressure plate nut.

Tighten torque	
16 N·m	12 lb. ft.

KC0133-1D-M-RS

Figure 13 Compressor Assembly - E


PERFORMANCE TEST
LOW PRESSURE SIDE
2 kg/cm² (28.5 psi)
HIGH PRESSURE SIDE
15kg/cm² (213psi)
0
2
4
6
8
10
76
cmHg kg/cm
0
5
10
15
20
25
30
76
cmHg kg/cm
LO
HI

PERFORMANCE TEST OF COMPRESSOR

Performance test of the repaired compressor is made by installing the compressor on the vehicle and checking the pressure measurements made with gage manifold while operating the air conditioning system. On the method for mounting the gage manifold, refer to the evacuating procedures already related.

NORMAL OPERATION

Measure the pressures with the suction port air temperature at around 30° to 35°C (85° to 95°F), engine speed at 2,000 rpm, and at strongest cooling setting.

Standard Pressures	
Low pressure side	1.5 — 2.0 kg/cm² (21.3 — 28.4 psi)
High pressure side	14.5 — 15 kg/cm² (206 — 213 psi)

KC0134-1D-M-RS

Figure 14 Charging Procedures

SPECIAL TOOLS.

NO.	TOOL NAME	TOOL NO.	USE
1.	Pressure plate remover	J34878	To remove magnetic clutch plate.
2.	Seal plate remover	J9393-A	To remove seal plate
3.	Shaft seal remover	J34879	To remove/install shaft seal
4.	Key pressor	J34880	To install key

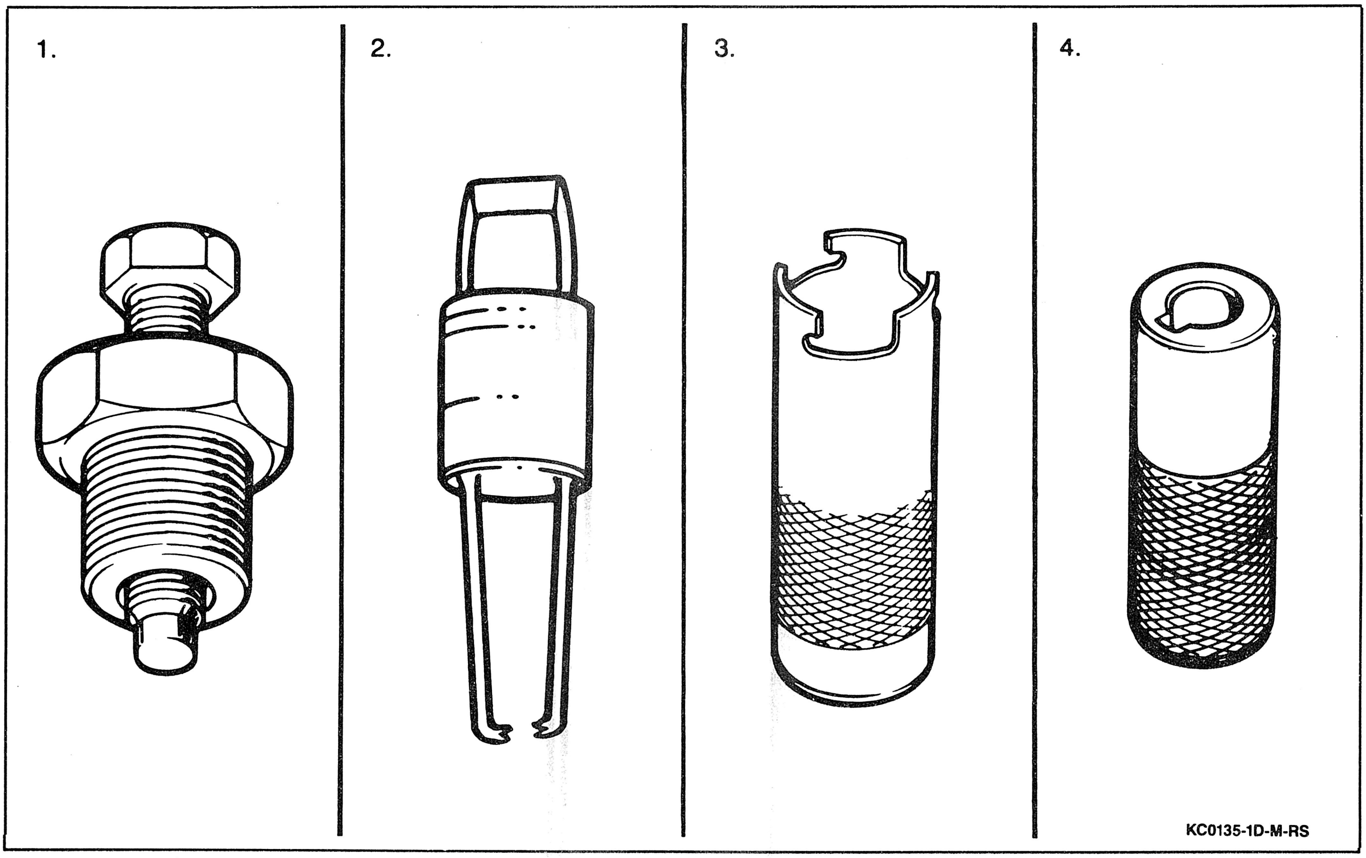


Figure 15 Tool Identification Chart

SECTION 2

BUMPERS, SHEET METAL, AND FRAME

CONTENTS

GENERAL DESCRIPTION 2-1
  Bumpers 2-1
  Sheet Metal 2-1
  Frame 2-1
ON-VEHICLE SERVICE 2-1
  Front Bumper Support 2-1
  Front Bumper Cover Fascia 2-2
  Rear Bumper Support 2-2
  Rear Bumper Cover Fascia 2-2
  Battery Tray 2-2
  Hood 2-2
  Hood Hinge 2-2
  Hood Latch 2-4
  Hood Latch Cable 2-4
  Front Fender 2-4
  Wheel Housing 2-4

NOTICE: Fasteners are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. They must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary.

Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to ensure proper retention of these parts.

GENERAL DESCRIPTION

BUMPERS

The front and rear bumpers are constructed with a full length support member secured directly to the body. The absorber extends the full length of the bumpers and is placed between the support member and the bumper covers.

SHEET METAL

Anti-corrosion materials have been applied to the interior surfaces of some metal panels to provide rust resistance. When servicing these panels, areas on which this material has been disturbed should be properly recoated with service-type anti-corrosion material.

FRAME

Underbody components must be properly aligned to ensure correct suspension location. In case of collision damage, it is important that the underbody be checked thoroughly and, if necessary, realigned in order to accurately establish proper dimensions.

Refer to the Body Service Manual (Section 3) for specifications and service procedures on unitized construction bodies.

Since each part adds to the strength of the body, it is essential that proper welding, sealing, and rustproofing methods be used during service. The underbody components should be rustproofed whenever body repair operations which destroy or damage the original rustproofing are completed. When rustproofing critical underbody components,it is essential to use a good quality type of air-dry primer (such as corrosion-resistant zinc chromate). Do not use combination-type primer-surfacers.

ON-VEHICLE SERVICE

FRONT BUMPER SUPPORT

Figure 1

Remove or Disconnect

1. Right and left headlamp bezels.
2. Upper and lower cover retaining screws.
3. Turn signal lamp connectors.
4. Upper and lower covers.
5. Support retaining nuts and bolts.
6. Support from vehicle.

Install or Connect

1. Support and retaining nuts and bolts.
2. Upper and lower covers.
3. Turn signal lamp connectors.
4. Cover retaining screws.
5. Right and left headlamp bezels.

FRONT BUMPER COVER FASCIA

Figure 1

Remove or Disconnect

1. Right and left headlamp bezels.
2. Upper and lower cover retaining screws.
3. Turn signal lamp connectors.
4. Upper and lower cover fascias.
5. Turn signal lamps.

Install or Connect

1. Turn signal lamps.
2. Upper and lower cover fascias.
3. Turn signal lamp connectors.
4. Cover retaining screws.
5. Right and left headlamp bezels.

REAR BUMPER SUPPORT

Figure 2

Remove or Disconnect

1. License plate.
2. Right and left tail lamps.
3. Upper and lower cover retaining screws and covers.
4. Support retaining nuts and bolts.
5. Support from vehicle.

Install or Connect

1. Support and retaining nuts and bolts.
2. Upper and lower covers and retaining screws.
3. Right and left tail lamps.
4. License plate.

REAR BUMPER COVER FASICA

Figure 2

Remove or Disconnect

1. License plate.
2. Right and left tail lamps.
3. Upper and lower cover retaining screws.
4. Upper and lower cover fascia.

Install or Connect

1. Upper and lower cover fascia and retaining screws.
2. Right and left tail lamps.
3. License plate.

BATTERY TRAY

Remove or Disconnect

1. Positive and negative battery cables.
2. Hold down frame.
3. Battery.
4. Tray retaining bolts.
5. Tray from vehicle.

Install or Connect

1. Tray.
2. Tray retaining bolts.
3. Battery.
4. Hold down frame.
5. Positive and negative battery cables.

HOOD

Figures 3, 4, and 5

Remove or Disconnect

1. Raise hood.
   - Install protective covering over fenders to prevent paint damage.
2. Mark position of hinges to hood for easy assembly.
3. Support hood and remove retaining bolts.
4. Hood from vehicle.

Install or Connect

1. Hood.
2. Retaining bolts and position hood with locating mark from removal.

Inspect

- For proper hood alignment and operation.

Adjust

- Fore, aft, right, and left hood, adjustments.
  1. Slacken the four mounting bolts for the adjustments.

NOTICE: When replacing the hood be sure to apply anti-corrosive treatment to the mating surfaces.

- Vertical adjustment.
  1. Turn the rubber bumpers for adjustment.

HOOD HINGE

Figures 3, 4, and 5

Remove or Disconnect

1. Open hood and support.
2. Cowl ventilator.
   - Mark hinge location on hood and cowl.
3. Hood hinge retaining bolts.
4. Hinge to cowl retaining bolts.
5. Hinge from vehicle.

Install or Connect

1. Hinge.
2. Hinge to cowl retaining bolts.
   - Align hinge with marks on hood.
3. Cowl ventilator.

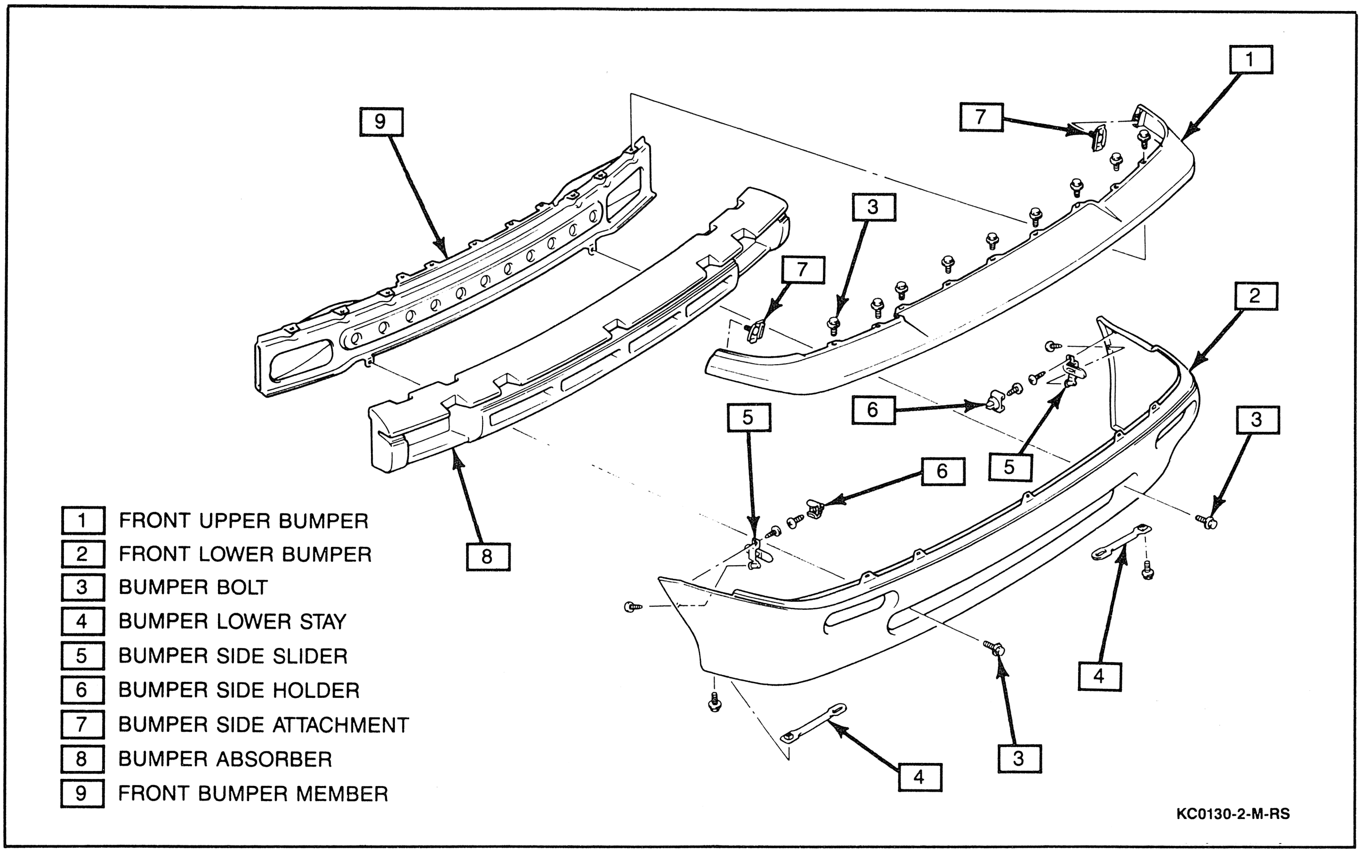

1 FRONT UPPER BUMPER
2 FRONT LOWER BUMPER
3 BUMPER BOLT
4 BUMPER LOWER STAY
5 BUMPER SIDE SLIDER
6 BUMPER SIDE HOLDER
7 BUMPER SIDE ATTACHMENT
8 BUMPER ABSORBER
9 FRONT BUMPER MEMBER
1
2
3
4
5
6
7
8
9
KC0130-2-M-RS

Figure 1 Front Bumper Assembly

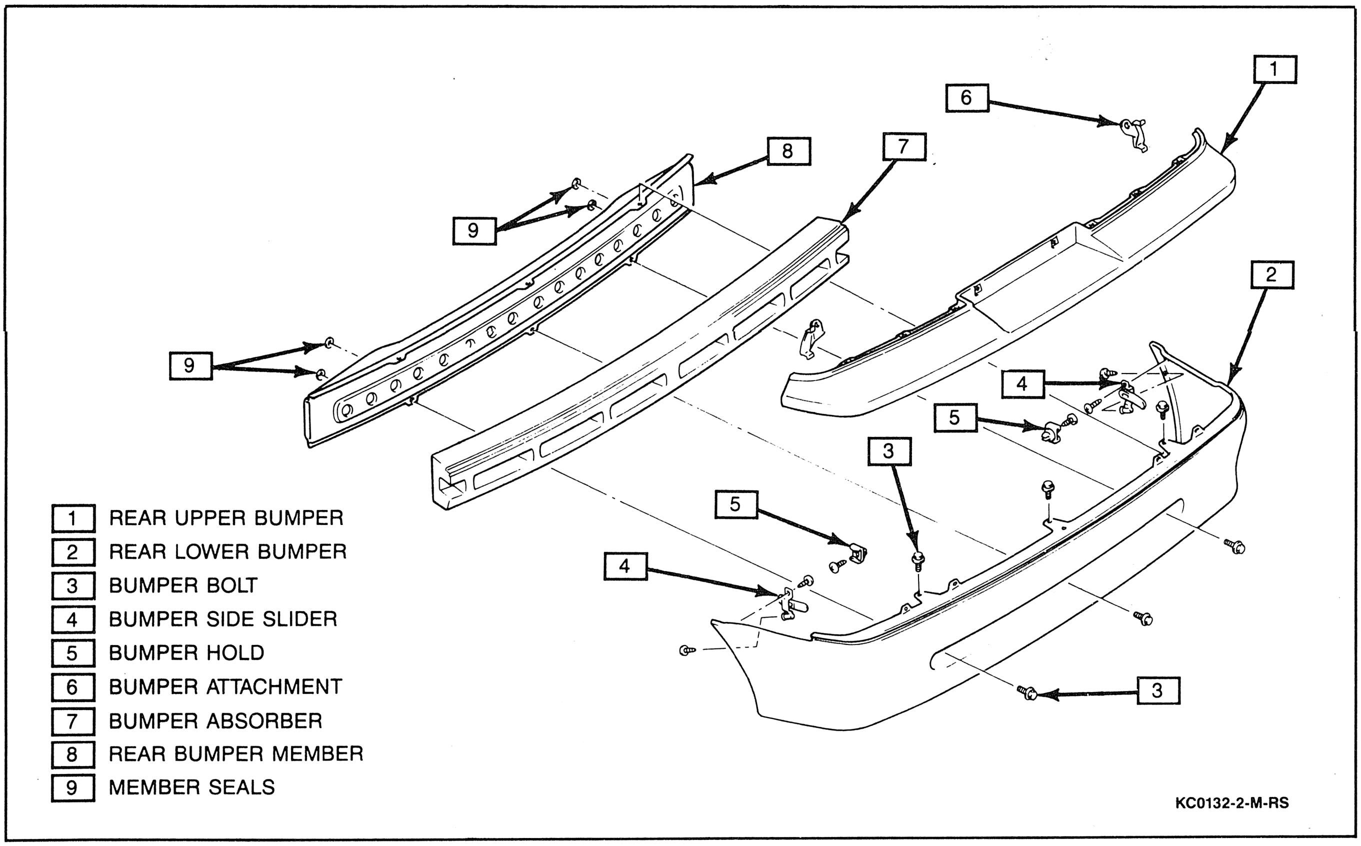

1 REAR UPPER BUMPER
2 REAR LOWER BUMPER
3 BUMPER BOLT
4 BUMPER SIDE SLIDER
5 BUMPER HOLD
6 BUMPER ATTACHMENT
7 BUMPER ABSORBER
8 REAR BUMPER MEMBER
9 MEMBER SEALS
1
2
3
4
5
6
7
8
9
KC0132-2-M-RS

Figure 2 Rear Bumper Assembly

4. Hood hinge retaining bolts.

Inspect

- For proper hood alignment and operation.

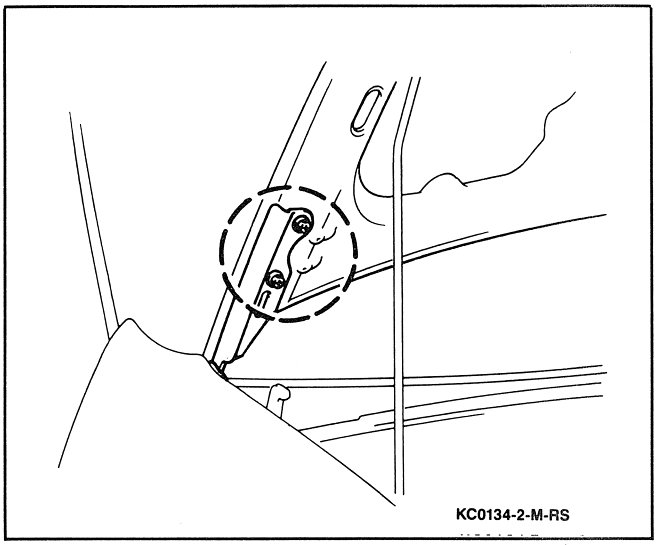


Figure 3 Hood Mounting Bolts (Right Side)

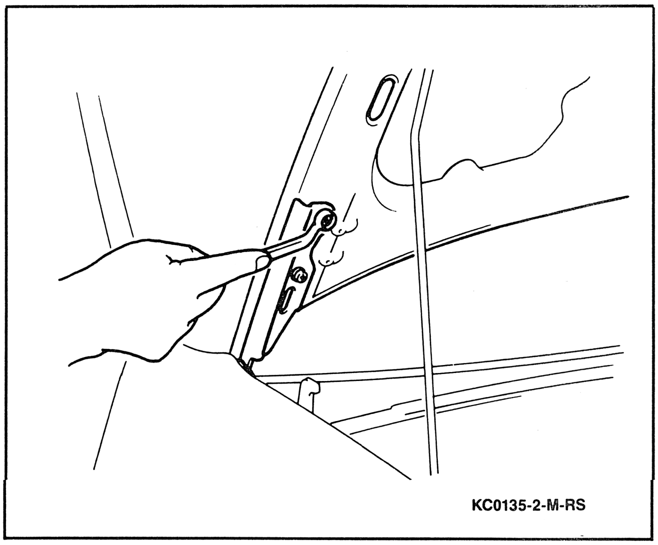


Figure 4 Hood Adjustment Bolts (Right Side)

HOOD LATCH

Figure 6

Remove or Disconnect

1. Open hood and support.
2. Cable.
3. Latch retaining bolts.
4. Latch from vehicle.

Install or Connect

1. Latch.
2. Cable to latch.
3. Latch retaining bolts.

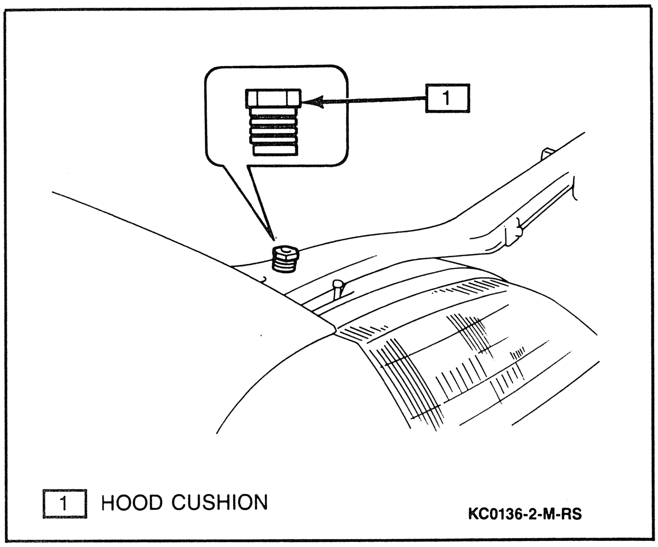


Figure 5 Vertical Hood Adjustment

Inspect

- For proper alignment and operation.

Adjust

- Loosen the hood latch attaching screws for the hood latch-to-striker alignment.

HOOD LATCH CABLE

Remove or Disconnect

1. Open and support hood.
2. Hood latch.
3. Cable at latch.
4. Left front wheel.
5. Left front fender inner skirt.
6. Handle assembly from dash.
7. Cable from inside release handle.
8. Cable from cowl panel.

Install or Connect

1. Cable through cowl panel.
2. Cable at release handle.
3. Handle assembly to dash.
4. Left front fender inner skirt.
5. Left front wheel.
6. Cable to latch.
7. Latch.

Adjust

- For proper alignment and operation.

FRONT FENDER

Figures 7 and 8

Remove or Disconnect

1. Parking lamp assembly.
2. Front wheel.
3. Inner wheel skirt.

4. Fender retaining bolts at door pillar.
5. Fender upper retaining bolts.
6. Remaining fender retaining bolts.
7. Fender from vehicle.

NOTICE: When replacing the front fender, be sure to apply anti-corrosive treatment to the replacement fender. Refer to Body General Information (Section 10-1).

→← Install or Connect

1. Fender.
2. Fender retaining bolts.
3. Inner wheel skirt.
4. Front wheel.
5. Parking lamp assembly.

WHEEL HOUSING

Figure 8

←→ Remove or Disconnect

1. Front wheel.
2. Inner wheel house skirt.

→← Install or Connect

1. Inner wheel house skirt.
2. Front wheel.

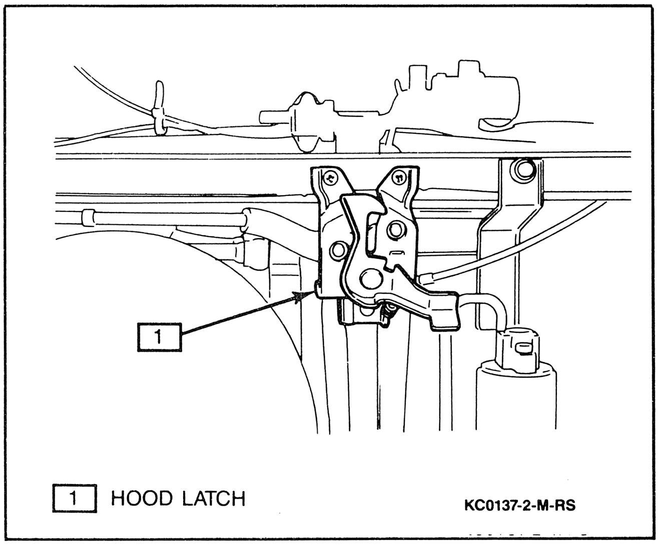

1
1 HOOD LATCH
KC0137-2-M-RS

Figure 6 Hood Latch

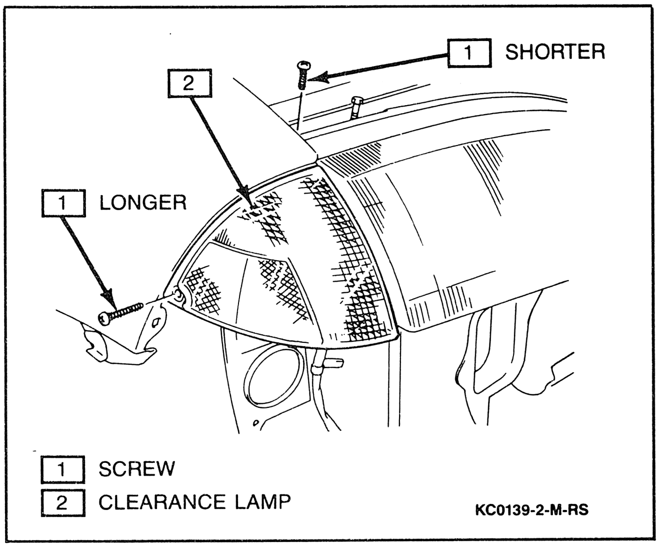

2
1 SHORTER
1 LONGER
1 SCREW
2 CLEARANCE LAMP
KC0139-2-M-RS

Figure 7 Parking Lamp Assembly

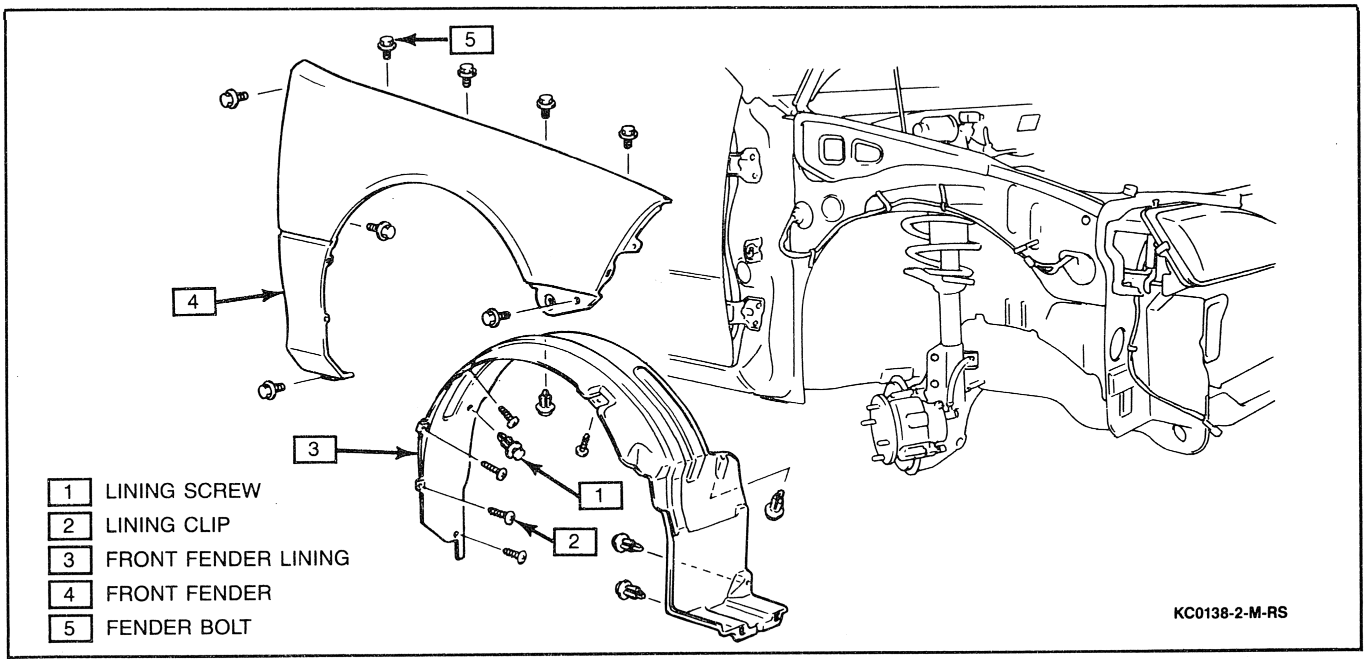

5
4
3
1
2
1 LINING SCREW
2 LINING CLIP
3 FRONT FENDER LINING
4 FRONT FENDER
5 FENDER BOLT
KC0138-2-M-RS

Figure 8 Front Fender Assembly (Right Side)

SECTION 3

STEERING, SUSPENSION, WHEELS, AND TIRES

CONTENTS

DIAGNOSIS 3-1
WHEEL ALIGNMENT 3A-1
MANUAL RACK AND PINION 3B-1
FRONT SUSPENSION 3C-1
REAR SUSPENSION 3D-1
WHEELS AND TIRES 3E-1
STEERING WHEEL AND COLUMN 3F-1

DIAGNOSIS

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TIRE DIAGNOSIS 3-6
Tire Wear Indicators 3-6
Radial Tire Waddle 3-6
Radial Tire Lead 3-7
VIBRATION DIAGNOSIS 3-7

GENERAL DIAGNOSIS

Since the problems in steering, suspension, wheels and tires involve several systems, they must all be considered when diagnosing a complaint. To avoid using the wrong symptom, always road test the car first. Proceed with the following preliminary inspections and correct any defects which are found.

1. Inspect tires for proper pressure and uneven wear.
2. Raise car on a hoist and inspect front and rear suspension and rack and pinion for loose or damaged parts.
3. Spin front wheels. Inspect for out-of-round tires, out-of-balance tires, bent rims, loose and/or rough wheel bearings.

GENERAL DIAGNOSIS CHART A

Condition	Possible Cause	Correction
Car Pulls (leads)	1. Mismatched or uneven tires.	Replace tire.
	2. Tires not adequately inflated.	Adjust tire pressure.
	3. Broken or sagging springs.	Replace spring.
	4. Radial tire lateral force.	Replace tire.
	5. Disturbed front end alignment.	Check and adjust front end alignment.
	6. Disturbed rear wheel alignment.	Check and adjust rear wheel alignment.
	7. Brake dragging in one road wheel.	Repair front brake.
	8. Loose, bent or broken front or rear suspension parts.	Tighten or replace suspension part.

GENERAL DIAGNOSIS CHART B

Condition	Possible Cause	Correction
Abnormal or Excessive Tire Wear	1. Sagging or broken springs.	Replace spring.
	2. Tire out of balance.	Adjust balance or replace tire.
	3. Disturbed front end alignment.	Check front end alignment.
	4. Faulty shock absorber.	Replace shock absorber.
	5. Hard driving.	Replace tire.
	6. Overloaded car.	Replace tire.
	7. Lack of tire rotation.	Replace or rotate tire.
	8. Worn or loose road wheel bearings.	Replace wheel bearing.
	9. Wobbly wheel or tire.	Replace wheel or tire.
	10. Tires not adequately inflated.	Adjust the pressure.
Wheel Tramp	1. Blister or bump on tire.	Replace tire.
	2. Improper shock absorber action.	Replace shock absorber.
Shimmy, Shake or Vibration	1. Tire or wheel out of balance.	Balance wheels or replace tire and/or wheel.
	2. Loose wheel bearings.	Replace wheel bearing.
	3. Worn tie rod ends.	Replace tie rod end.
	4. Worn lower ball joints.	Replace front suspension control arm.
	5. Excessive wheel runout.	Repair or replace wheel and/or tire.
	6. Blister or bump on tire.	Replace tire.
	7. Excessively loaded radial runout of tire/wheel assembly.	Replace tire or wheel.
	8. Disturbed front end alignment.	Check front end alignment.
	9. Loose or worn steering linkage.	Tighten or replace steering linkage.
	10. Loose steering gear case bolts.	Tighten case bolts.
Hard Steering	1. Bind in tie rod end ball studs or lower ball joints.	Replace tie rod end or front suspension control arm.
	2. Disturbed front end alignment.	Check front end alignment.
	3. Rack and pinion adjustments.	Check and adjust rack and pinion torque.
	4. Tire not adequately inflated.	Inflate tires to proper pressure.
	5. Bind in steering column.	Repair or replace.

GENERAL DIAGNOSIS CHART C

Condition	Possible Cause	Correction
Too Much Play In Steering	1. Wheel bearings worn.	Replace wheel bearing.
	2. Rack and pinion attachments loose.	Tighten or repair.
	3. Rack and pinion adjustments.	Check and adjust rack and pinion torque.
	4. Worn steering shaft joints.	Replace joint.
	5. Worn tie rod ends or tie rod inside ball joints.	Replace tie rod end or tie rod.
	6. Worn lower ball joints.	Replace front suspension control arm.
Poor Returnability	1. Bind in tie rod end ball studs.	Replace tie rod end.
	2. Bind in ball joints.	Replace ball joint.
	3. Bind in steering column.	Repair or replace.
	4. Lack of lubricant rack and pinion.	Check, repair or lubricate rack and pinion.
	5. Disturbed front end alignment.	Check and adjust front end alignment.
	6. Rack and pinion adjustments.	Check and adjust rack and pinion torque.
	7. Tires not adequately inflated.	Adjust tire pressure.
Rack and Pinion Noise (Rattle or Chuckle)	1. Rack and pinion attachments loose.	Tighten steering gear case mounting bolts.
	2. Worn back bushing.	Replace rack bushing.
	3. Rack and pinion adjustment.	Check and adjust rack and pinion torque.
Abnormal Noise, Front End	1. Worn, sticky or loose tie rod ends, lower ball joints, tie rod inside ball joints or drive shaft joints.	Replace tie rod end, control arm, tie rod or drive shaft joint.
	2. Damaged shock absorbers, struts or mountings.	Replace or repair.
	3. Worn control arm bushings.	Replace.
	4. Loose wheel nuts.	Tighten wheel nuts.
	5. Loose suspension bolts or nuts.	Tighten suspension bolts or nuts.
	6. Broken or otherwise damaged wheel bearings.	Replace wheel bearing.
	7. Broken suspension springs.	Replace spring.
	8. Poorly lubricated or worn strut bearings.	Lubricate or replace strut bearing.

GENERAL DIAGNOSIS CHART D

Condition	Possible Cause	Correction
Wander Or Poor Steering Stability	1. Mismatched or uneven tires.	Replace tire or inflate tires to proper pressure.
	2. Loose ball joints and tie rod ends.	Replace suspension control arm or tie rod end.
	3. Faulty shock absorbers/struts or mounting.	Replace absorber/strut or repair mounting.
	4. Broken or sagging springs	Replace spring.
	5. Rack and pinion adjustment.	Check or adjust rack and pinion torque.
	6. Front end alignment.	Check front end alignment.
Erratic Steering When Braking	1. Worn wheel bearings.	Replace wheel bearing.
	2. Broken or sagging springs.	Replace spring.
	3. Leaking wheel cylinder or caliper.	Repair or replace wheel cylinder or caliper.
	4. Warped discs.	Replace brake disc.
	5. Badly worn brake shoe linings.	Replace brake shoe lining.
	6. Drum is out of round.	Replace brake drum.
	7. Wheel tires are inflated unequally.	Inflate tires to proper pressure.
	8. Defective wheel cylinders.	Replace or repair wheel cylinder.
	9. Disturbed front end alignment.	Check and adjust front end alignment.
Low Or Uneven Trim Height (Figure 3-1) Difference between right and left trim heights should be within 15mm (0.6 in) of each other (Applies to front and rear).	1. Broken or sagging springs.	Replace spring.
	2. Overloaded.	Check loading.
	3. Incorrect springs.	Replace spring.
Suspension Bottoms	1. Overloaded.	Check loading.
	2. Faulty shocks or struts.	Replace shock absorber or strut.
	3. Incorrect, broken or sagging springs.	Replace spring.
Ride Too Soft	1. Faulty shock absorbers or struts.	Replace shock absorber or strut.

GENERAL DIAGNOSIS CHART E

Condition	Possible Cause	Correction
Body Leans Or Sways In Corners	1. Faulty shock absorbers, struts or mounting.	Replace shock absorber, strut or tighten mounting.
	2. Broken or sagging springs.	Replace spring.
	3. Overloaded.	Check loading.
Cupped Tires	1. Defective front struts.	Replace strut.
	2. Worn wheel bearings.	Replace wheel bearing.
	3. Excessive tire or wheel run-out.	Replace tire or wheel disc.
	4. Worn ball joints.	Replace front suspension control arm.
	5. Tire out of balance.	Adjust tire balance.

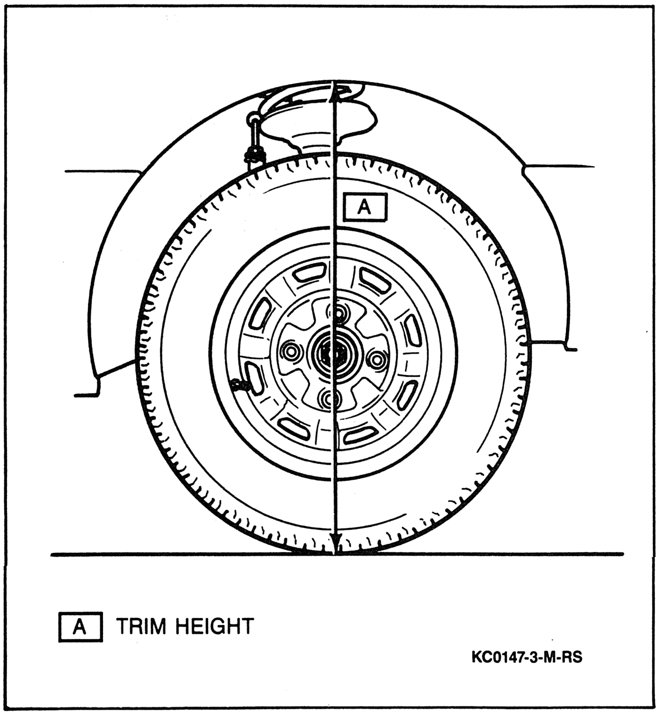


Figure 3-1 - Trim Height Adjustment

TIRE DIAGNOSIS

A wheel alignment check is in order if the following conditions are noted:

1. Left and right front tire wear is unequal.
2. Wear is uneven across the tread of any front tire.
3. Front Tire treads have scuffed appearance with "feather" edges on one side of tread ribs or blocks.

Wear Indicators

Figure 3-3

The original equipment tires have built-in tread wear indicators to show when tires need replacement. These indicators will appear as 12mm (0.47 inch) wide bands when the tire tread depth becomes 1.6mm (0.063 inch). When the indicators appear in 3 or more grooves at 6 locations, tire replacement is recommended.

Radial Tire Waddle

Figure 3-4

Waddle is side to side movement at the front and/or rear of the car. It is caused by the steel belt not being straight within the tire. It is most noticeable at low speed, 5 to 30 mph.

It is possible to road test a car and tell on which end of the car the faulty tire is located. If the waddle tire is on the rear, the rear end of the car will shake from side to side or "waddle". From the driver's seat it feels as though someone is pushing on the side of the car.

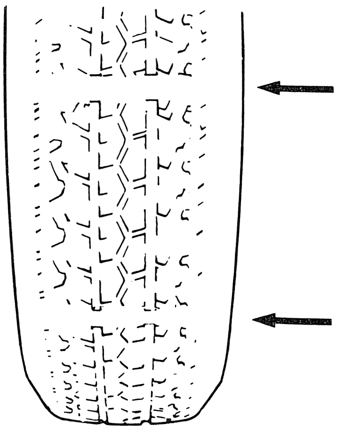


Figure 3-3 - Tire Wear Indicator

If the faulty tire is on the front, the waddle is more visual. The front sheet metal appears to be moving back and forth and the driver feels as though he is at the pivot point in the car.

Waddle can be quickly diagnosed by using a Tire Problem Detector (TPD) and following the equipment manufacturer's recommendations.

If a TPD is not available, the more time consuming method of substituting known good tire/wheel assemblies on the problem car can be used as follows:

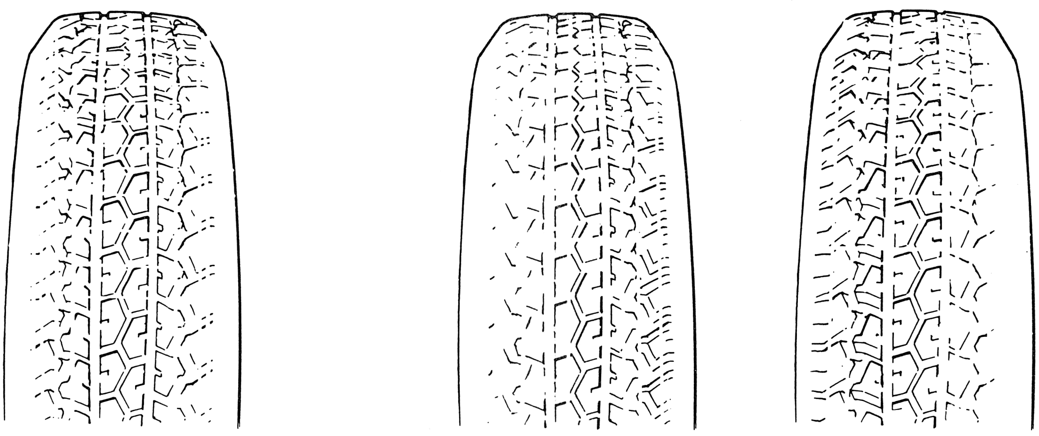
TIRE DIAGNOSIS

Irregular and/or Premature Wear

Irregular and premature wear has many causes. Some of them are: incorrect inflation pressures, lack of tire rotation, driving habits, improper alignment.

If the following conditions are noted, rotation is in order:

1. Front tire wear is different from rear.
2. Uneven wear exists across the tread of any tire.
3. Left front and right front tire wear is unequal.
4. Left rear and right rear tire wear is unequal.
5. There is cupping, flat spotting, etc.



- Hard Cornering
- Under Inflation
- Lack of Rotation

- Incorrect Wheel Alignment
- Tire Construction Non-Uniformity
- Wheel Heavy Acceleration

Figure 3-2 - Tire Wear Diagnosis

1. Ride car to determine if the waddle is coming from the front or rear.
2. Install tires and wheels that are known to be good (on similar car) in place of those on the offending end of the car. If the waddle cannot be isolated to front or rear, substitute the rears.
3. Road test again. If improvement is noted, install originals one at a time until offender is found. If no improvement is noted, install known good tires in place of all four. Then install originals one at a time until offender if found.

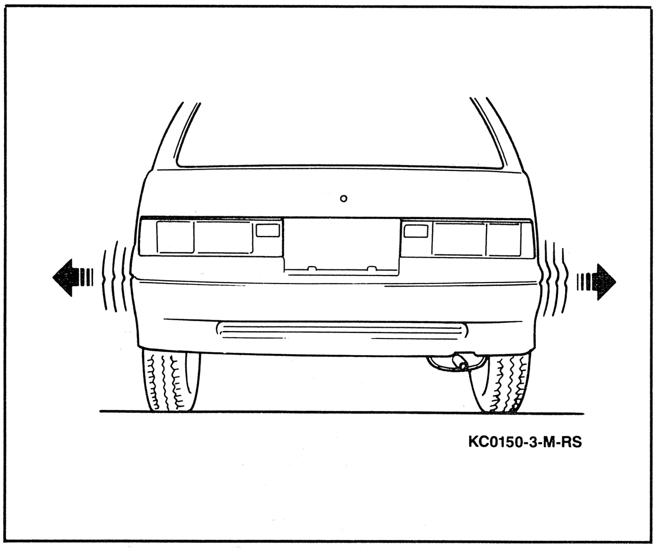


Figure 3-4 - Radial Tire Waddle

Radial Tire Lead

"Lead" is the deviation of the car from a straight path on a level road with no pressure on the steering wheel.

Lead is usually caused by:

1. Incorrect alignment.
2. Uneven brake adjustment.
3. Tire construction.

The way in which a tire is built can produce lead in a car. An example of this is placement of the belt. Off center belts on radial tires can cause the tire to develop a side force while rolling straight down the road. If one side of the tire is a little larger diameter then the other, the tire will tend to roll to one side. This will develop a side force which can produce car lead.

The procedure in Figure 3-5 should be used to make sure that front alignment is not mistaken for tire lead.

1. Part of the lead diagnosis procedure is different from the proper tire rotation pattern currently in the owner and service manuals. If a medium to high mileage tire is moved to the other side of the car, be sure to check that ride roughness has not developed.
2. Rear tires will not cause lead.

VIBRATION DIAGNOSIS

Wheel unbalance causes most of the highway speed vibration problems. If a vibration remains after dynamic balancing, it can be caused by three things (Figure 3-6).

1. Tire runout.
2. Wheel runout.
3. Tire stiffness variation.

Measuring tire and/or wheel free runout will uncover only part of the problem. All three causes, known as loaded radial runout, must be checked by using a Tire Problem Detector (TPD). If a TPD is not available, the more time consuming method of substituting known good tire and wheel assemblies on the problem car can be used.

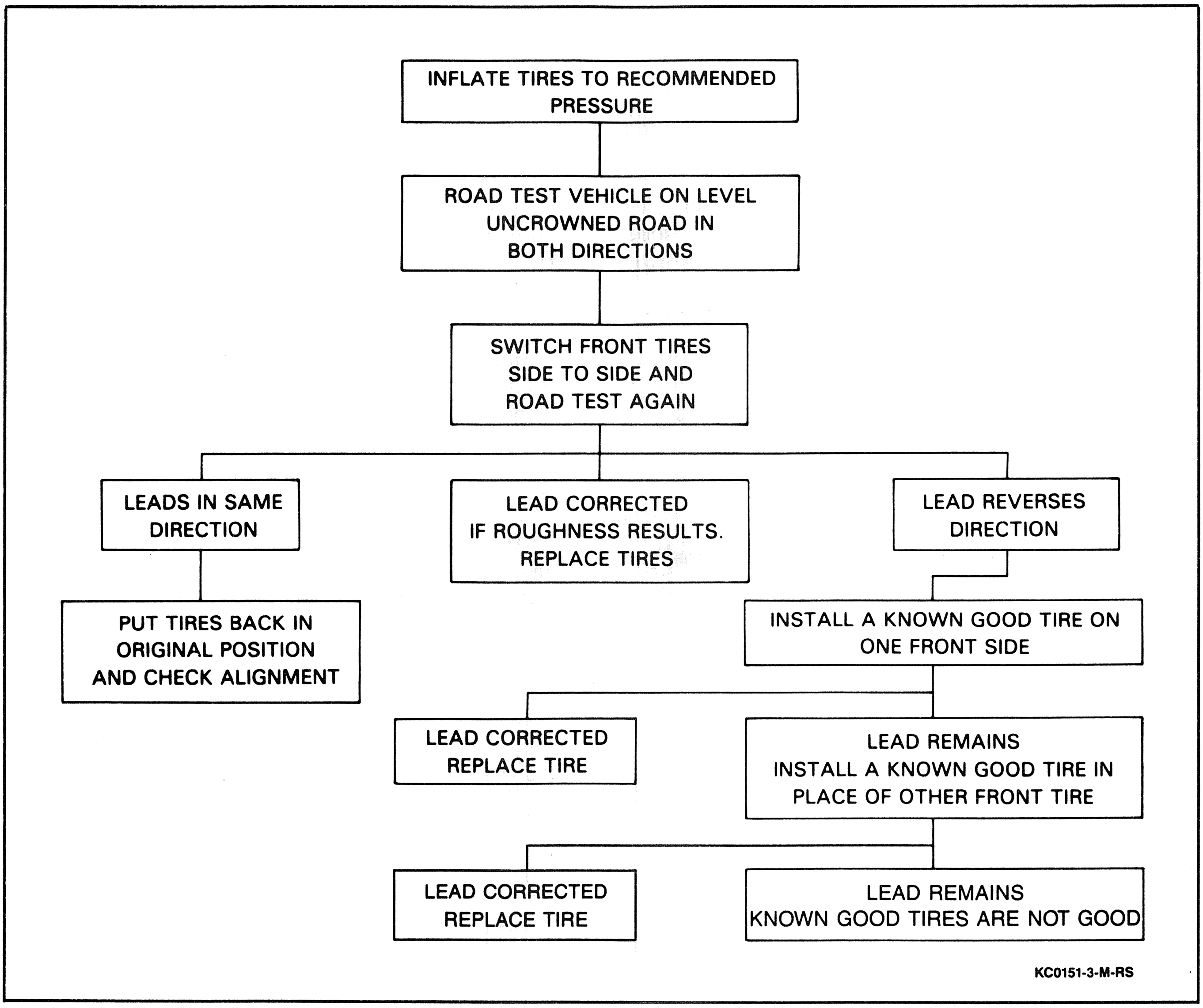

INFLATE TIRES TO RECOMMENDED PRESSURE
ROAD TEST VEHICLE ON LEVEL UNCROWNED ROAD IN BOTH DIRECTIONS
SWITCH FRONT TIRES SIDE TO SIDE AND ROAD TEST AGAIN
LEADS IN SAME DIRECTION
LEAD CORRECTED IF ROUGHNESS RESULTS. REPLACE TIRES
LEAD REVERSES DIRECTION
PUT TIRES BACK IN ORIGINAL POSITION AND CHECK ALIGNMENT
INSTALL A KNOWN GOOD TIRE ON ONE FRONT SIDE
LEAD CORRECTED REPLACE TIRE
LEAD REMAINS INSTALL A KNOWN GOOD TIRE IN PLACE OF OTHER FRONT TIRE
LEAD CORRECTED REPLACE TIRE
LEAD REMAINS KNOWN GOOD TIRES ARE NOT GOOD
KC0151-3-M-RS

Figure 3-5 - Lead Diagnosis

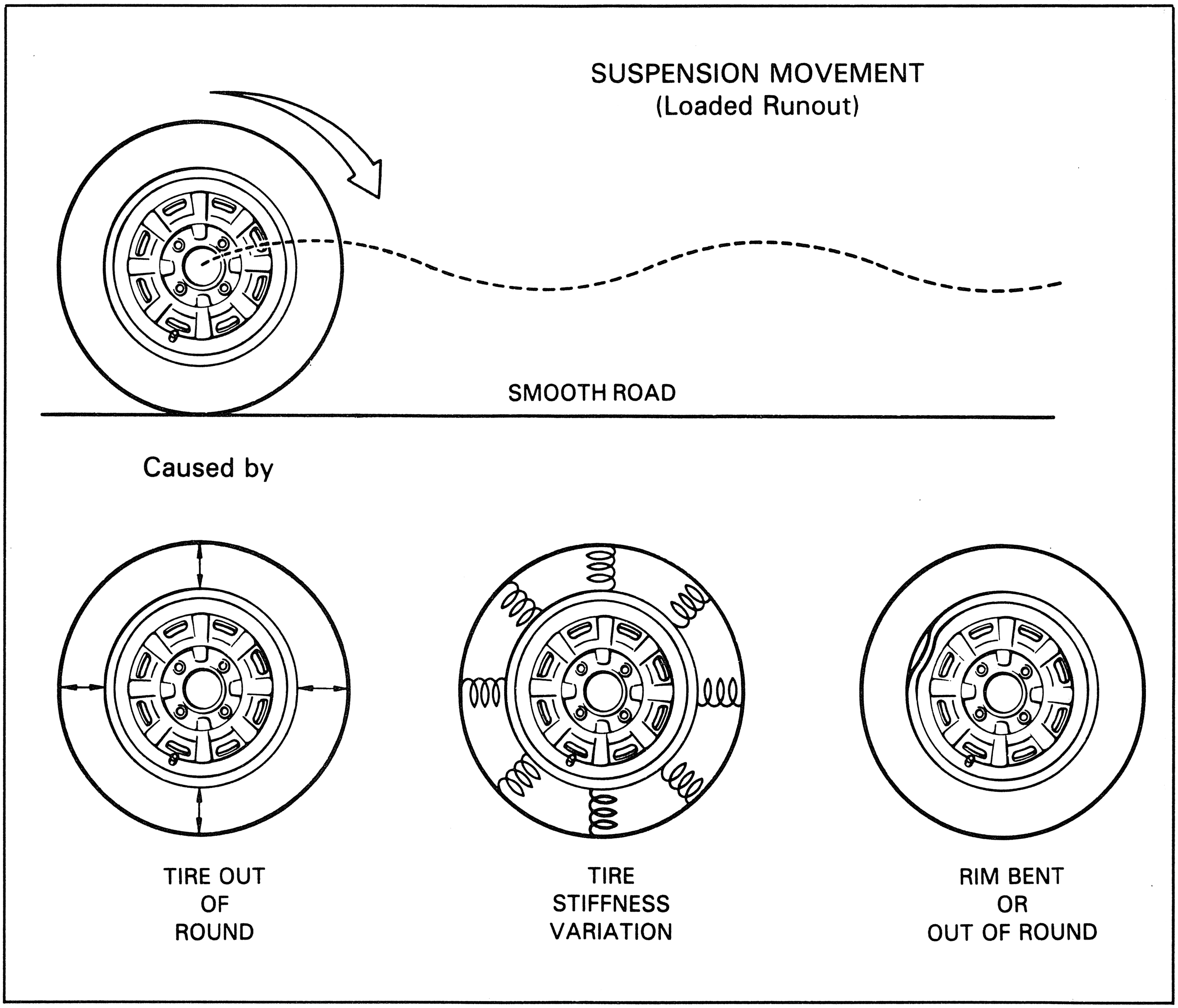

SUSPENSION MOVEMENT
(Loaded Runout)
SMOOTH ROAD
Caused by
TIRE OUT OF ROUND
TIRE STIFFNESS VARIATION
RIM BENT OR OUT OF ROUND

Figure 3-6 - Vibration

SECTION 3A

WHEEL ALIGNMENT

NOTICE: When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are reused, and those requiring thread locking compound will be called out. The correct torque value must be used when installing fasteners that require it. If the above conditions are not followed, parts or system damage could result.

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  Alignment Preliminary Steps 3A-1
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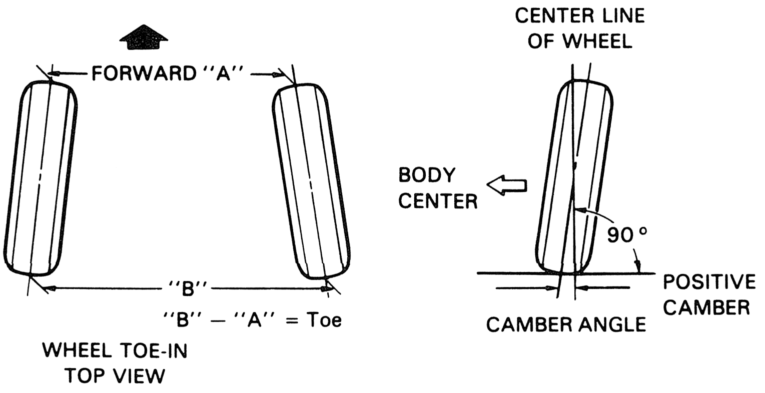
  Steering Angle 3A-3

GENERAL INFORMATION



ALIGNMENT SERVICE DATA	
TOE	
Front	0 ± 2 mm (–0.079 ± 0.078 in)
Rear	2 ± 2 mm (0.079 ± 0.079 in)
CAMBER	
Front	0 ± 1°
Rear	0 ± 1°
CASTER	
Front	3° ± 2° (16 mm 0.65 in)
TURNING ANGLE	
Inside	38°
Outside	32°
SIDE SLIP LIMIT:	
Front is less than 3 mm/m (0.118 in/3 ft)	
Rear is 2 ± 3 mm/m (0.079 ± 0.118 in/3 ft)	

LC0001-3A-M-RS

Figure 3A-1 - Alignment Specifications

WHEEL ALIGNMENT

Wheel alignment refers to the angular relationship between the wheels, suspension attaching parts, and the ground. The angle of the knuckle away from the vertical, the pointing in or out of the wheels, the tilt of the wheels from vertical (when viewed from the front of the vehicle) and the tilt of the suspension members from vertical (when viewed from the side of the vehicle), are involved in alignment.

TOE

Figure 3A-1

Toe is the turning in or out of the front and rear wheels. The actual amount of toe is normally only a fraction of an inch. The purpose of a toe specification is to ensure parallel rolling of the wheels. (Excessive toe-in or toe-out may increase tire wear.) Toe also serves to offset the small deflections of the wheel support system which occur when the vehicle is rolling forward. Even when the wheels are set, slightly, when the vehicle is standing still, they tend to roll parallel on the road when the vehicle is moving.

Amount of toe can be obtained by subtracting "A" from "B" as shown in Figure 3A-1 and therefore is given in mm (in).

CASTER

Figure 3A-1

Caster is the tilting of the front steering axis either forward or backward from the vertical (when viewed from the side of the vehicle). A backward tilt is positive (+) and a forward tilt is negative (–). On the short and long arm type suspension you cannot see a caster angle without a special instrument, but you can understand that if you look straight down from the top of the upper control arm to the ground you would find that the ball joints do not line up (fore and aft) when a caster angle other than 0° is present. If you had a positive caster angle the lower ball joint would be slightly ahead (toward the front of the vehicle) of the upper ball joint center line. Caster is the forward or backward tilt of the steering axis as viewed from a side elevation.

CAMBER

Figure 3A-1

Camber is the tilting of the front and rear wheels from the vertical when viewed from the front of the vehicle. When the wheels tilt outward at the top, the camber is positive (+). When the wheels tilt inward, the camber is negative(–). The amount of tilt is measured in degrees from the vertical and this is the camber angle.

PRELIMINARY CHECKS PRIOR TO ADJUSTING WHEEL ALIGNMENT

Steering and vibration complaints are not always the result of improper alignment. An additional item to be checked is tire lead due to worn or improperly manufactured tires. "Lead" is the deviation of the car from a straight path on a level road without hand pressure on the steering wheel. Section 3 of this manual contains a procedure for determining a tire lead problem.

Before making any adjustment, the following checks and inspections should be made to insure correct alignment readings and alignment adjustments:

1. Check all tires for proper inflation pressures and uniform tread wear.
2. Check for loose ball joints. Check tie rod ends; if excessive looseness is noted, they should be replaced before adjusting toe.
3. Check for wheel and tire assembly run-out.
4. Check car trim heights; if not within specifications, corrections should be made. The corrections must be made before adjusting toe.
5. Check for loose control arms.
6. Set steering wheel in straight state.
7. Consideration must be given to excess loads, such as tool boxes. If this excess load is normally carried in the car, it should remain in the car during alignment checks.
8. Consider the condition of the equipment being used to check alignment and follow the manufacturer's instructions.
9. Regardless of equipment used to check alignment, the car must be on a level surface.

ON-CAR SERVICE

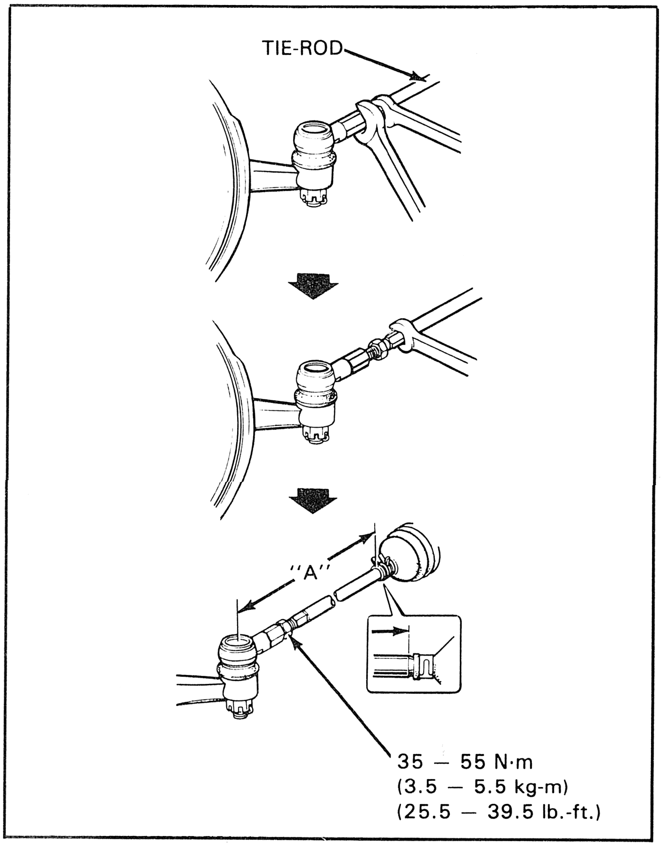
MEASURING FRONT ALIGNMENT ANGLES

Toe Adjustment

Front wheel toe is adjusted by changing tie rod length. Loosen right and left tie rod end lock nuts first and then turn right and left tie rods by the same amount to align toe-in to specification. In this adjustment, right and left tie rods should become equal in length ("A" in Figure 3A-2).

Before turning tie rods, apply grease between tie rods and rack boots so that the boots won't be twisted.

After adjustment, tighten lock nuts to specified torque and make sure that the rack boots are not twisted.



Figue 3A-2 Front Wheel Toe Adjustment

CAMBER AND CASTER ADJUSTMENT

Caster and camber cannot be adjusted. Should camber or caster be found out of specification, locate its cause first. If it is damaged, loose, bent, dented or worn suspension parts, they should be replaced. If it is the car body, it should be repaired to the proper specification.

To prevent incorrect reading of camber or caster, vehicle's front end must be moved up and down three times before inspection.

MEASURING REAR ALIGNMENT ANGLES

Toe Adjustment

Rear wheel toe is adjusted by the inside control rod bolts. Loosen right and left control rod inside nuts first and then turn right and left control rod inside bolts (cam bolts) by the same amount to align toe-in to specification.

After adjustment, tighten right and left inside nuts to specified torque while holding control rod inside bolt with another wrench to prevent it from turning (Figure 3A-3).

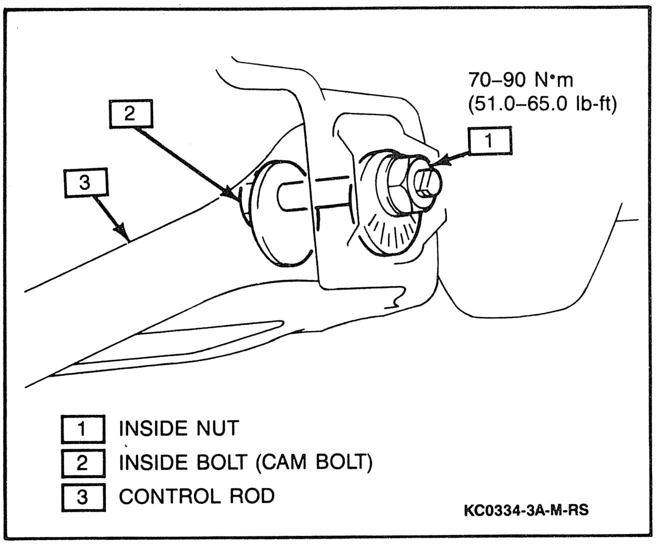


Figure 3A-3 - Rear Wheel Toe Adjustment

Camber And Caster Adjustment

Camber and caster can't be adjusted. Therefore, should the camber or caster be out of specification, locate its cause first. If the cause is damaged, loose, bent, dented, or worn suspension parts, they should be replaced. If the cause lies in the vehicle body, it should be repaired to the proper specification.

STEERING ANGLE

When a tie rod or tie rod end is replaced, check toe and steering angle with turning radius gages.

If the steering angle is not correct, check the right and left tie rods for equal length ("A" in Figure 3A-4).

NOTICE: If tie rod length is changed to correct steering angle, reinspect toe.

SECTION 3B

MANUAL RACK AND PINION

NOTICE: When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are reused, and those requiring thread locking compound will be called out. The correct torque value must be used when installing fasteners that require it. If the above conditions are not followed, parts or system damage could result.

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GENERAL DESCRIPTION

The rack and pinion steering system consists of two main components, the rack and the pinion. When the steering wheel is turned, the motion is transmitted to the steering shaft, shaft joint and then to the pinion. Since the pinion teeth mesh with teeth on rack, the motion is further transferred to the rack and changed to linear motion. The force is then transmitted through the tie rods to the steering knuckles which turn the wheels (Figure 3B-1).

LUBRICATION

When the inner parts of the steering gear case are disassembled, they should be washed clean before reassembly. It is recommended to use GM Manual Steering Gear Lube #1052182 where grease application is indicated in the text. See Required Service Material.

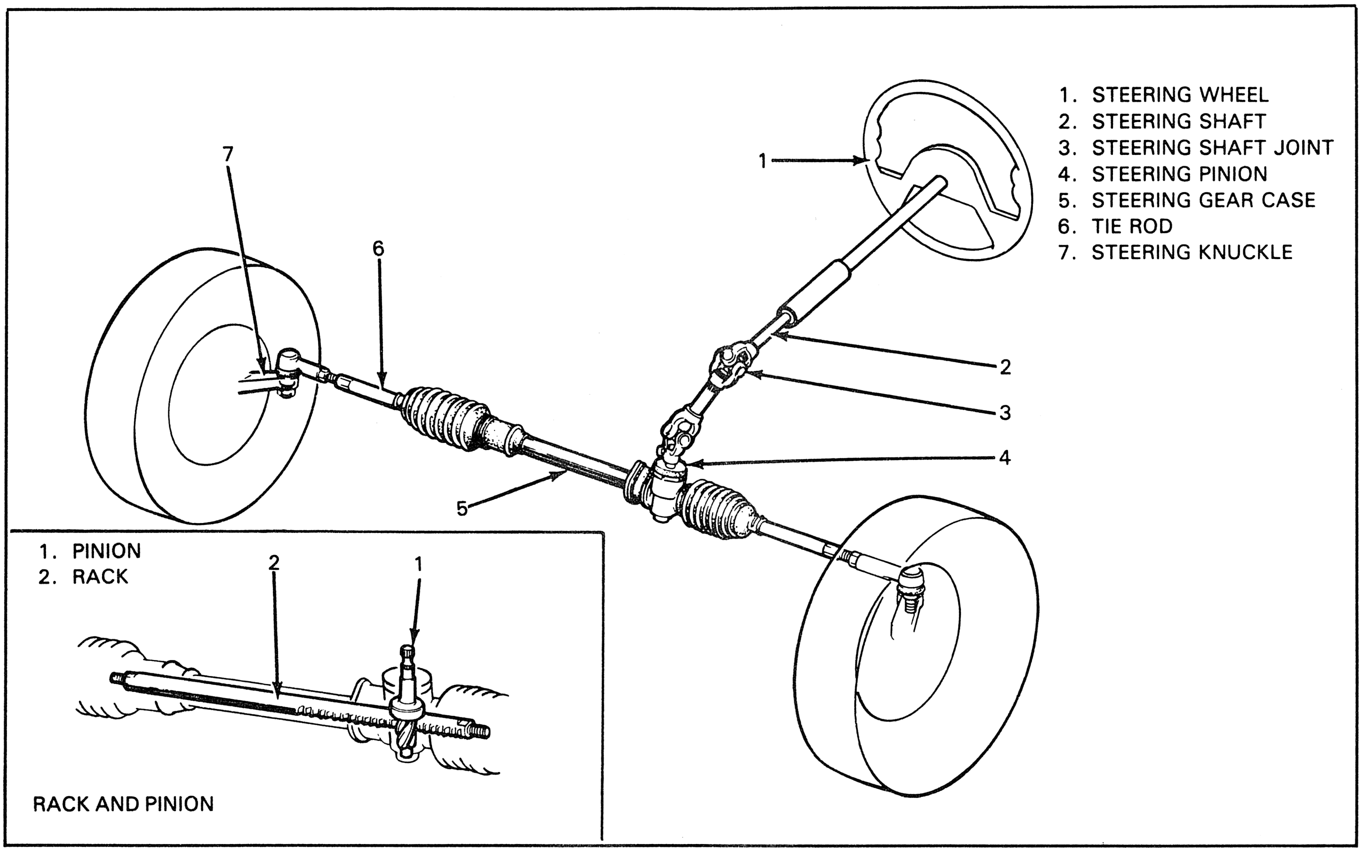
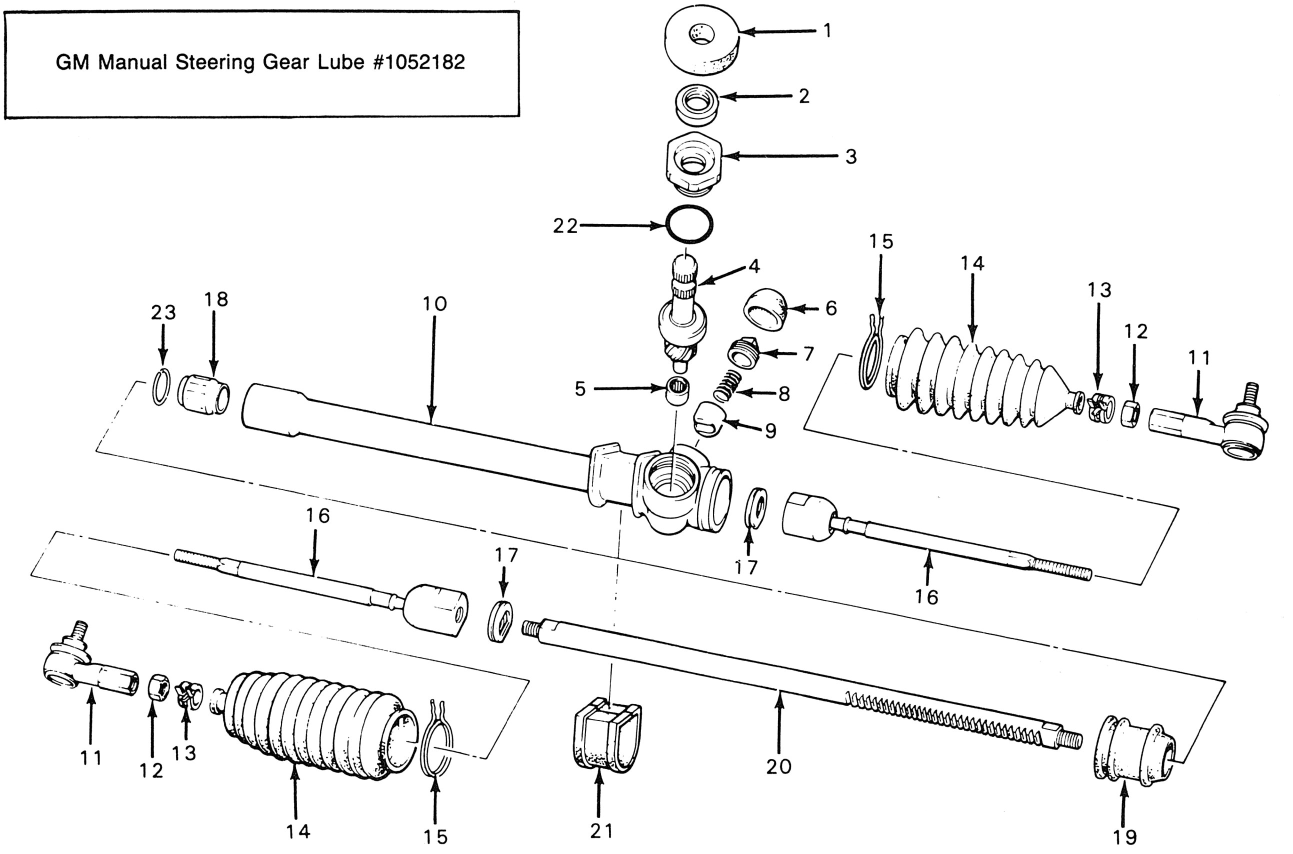

1. STEERING WHEEL
2. STEERING SHAFT
3. STEERING SHAFT JOINT
4. STEERING PINION
5. STEERING GEAR CASE
6. TIE ROD
7. STEERING KNUCKLE
7
1
6
2
3
4
5
1. PINION
2. RACK
2
1
RACK AND PINION

Figure 3B-1 - General Discription of Steering System


GM Manual Steering Gear Lube #1052182

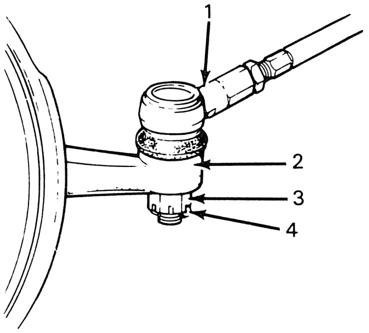
1. STEERING GEAR CASE PACKING
2. STEERING GEAR CASE OIL SEAL
3. PINION BEARING PLUG
4. STEERING PINION
5. STEERING PINION NEEDLE BEARING
6. RACK DAMPER SCREW CAP
7. RACK DAMPER SCREW
8. RACK PLUNGER SPRING
9. STEERING RACK PLUNGER
10. STEERING RACK HOUSING AND GEAR CASE
11. TIE-ROD END
12. TIE-ROD END LOCK NUT
13. RACK BOOT CLIP
14. BOOT
15. WIRE BOOT CLAMP
16. STEERING TIE-ROD
17. TIE-ROD LOCK WASHER
18. STEERING RACK BUSHING
19. STEERING RACK SIDE MOUNT
20. STEERING RACK
21. STEERING PINION SIDE MOUNT
22. GEAR CASE SEAL
23. SNAP RING

Figure 3B-2 - Exploded View of Manual Rack and Pinion

1. REMOVE AND INSTALL TIE ROD END

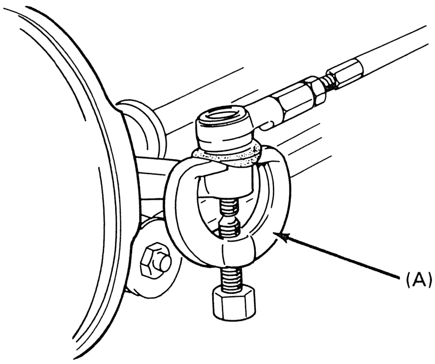
REMOVAL

1) Hoist vehicle and remove front wheel (Refer to WHEEL Section 3E).
2) Remove split pin and tie rod end castle nut from steering knuckle.



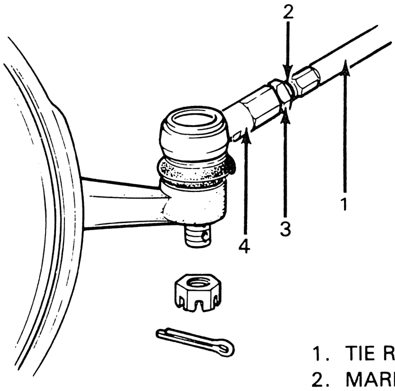
1. TIE ROD END
2. KNUCKLE
3. CASTLE NUT
4. SPLIT PIN

3) Disconnect tie rod end from knuckle, using special tool (A).



(A): TIE ROD END REMOVER J21687-02

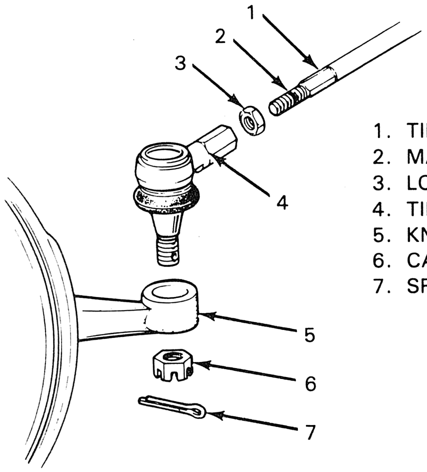
4) For ease of adjustment after installation, make marking of tie rod end lock nut position on tie rod thread. Then loosen lock nut and remove tie rod end from tie rod.



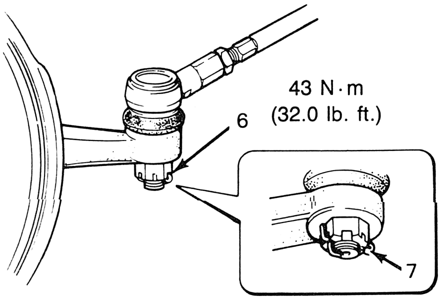
1. TIE ROD
2. MARKING TO BE MADE
3. TIE ROD END LOCK NUT
4. TIE ROD END

INSTALLATION

1) Install tie rod end lock nut and tie rod end to tie rod. Align lock nut with mark on tie rod thread.
2) Connect tie rod end to knuckle. Tighten castle nut until holes for split pin are aligned, but only within specified torque.
3) Bend split pin as shown below.
4) Install front wheel (Refer to WHEEL Section 3E).
5) Inspect the proper toe (Refer to FRONT END ALIGNMENT Section 3A).
6) After confirming proper toe, tighten tie rod end lock nut to specified torque.
7) Tighten wheel to specified torque and lower hoist.



1. TIE ROD
2. MARKING MADE
3. LOCK NUT
4. TIE ROD END
5. KNUCKLE
6. CASTLE NUT
7. SPLIT PIN



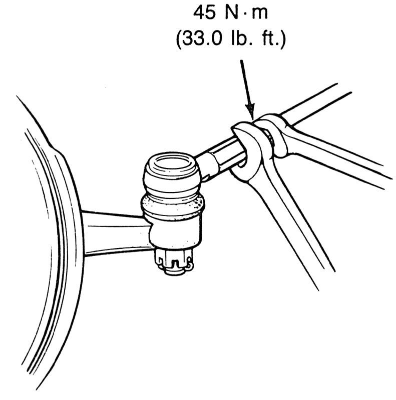
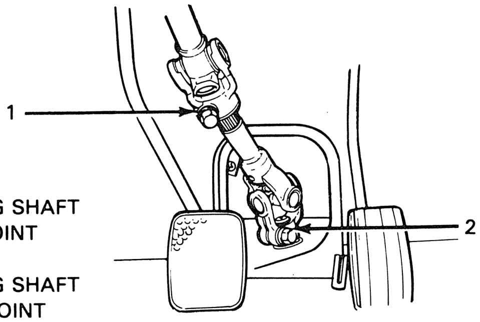


Figure 3B-3 - Tie Rod End

2. REMOVE AND INSTALL MANUAL RACK AND PINION ASSEMBLY (STEERING GEAR CASE)

REMOVAL

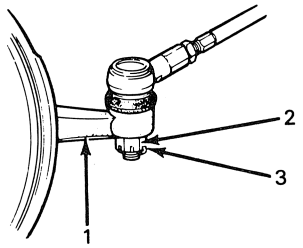
1) Slide driver's seat as far back as possible.
2) Pull off front part of floor mat on driver's side and remove steering shaft joint cover.
3) For ease of installation, loosen steering shaft upper joint bolt but don't remove.
4) Remove steering shaft lower joint bolt and disconnect lower joint from pinion.



1. STEERING SHAFT UPPER JOINT BOLT
2. STEERING SHAFT LOWER JOINT BOLT

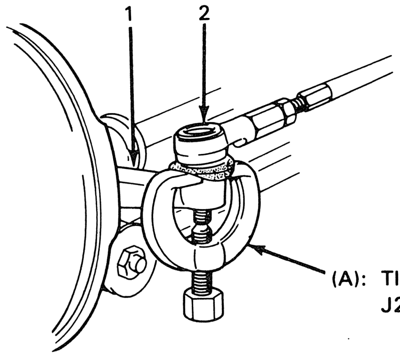
5) Hoist vehicle and remove both front wheels. Refer to WHEEL (Section 3E).
6) Remove split pins and tie rod castle nuts from both knuckles.

1. STEERING KNUCKLE
2. CASTLE NUT
3. SPLIT PIN



7) Disconnect both tie rod ends from knuckles, using special tool (A).

1. STEERING KNUCKLE
2. TIE ROD END



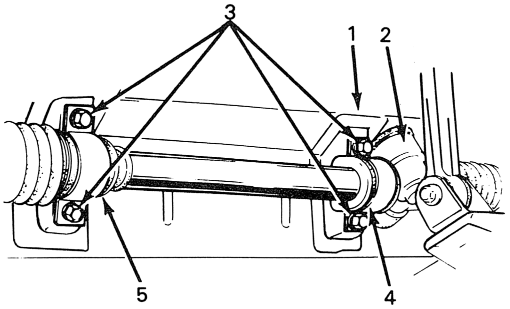
(A): TIE ROD END REMOVER J21687-02

INSTALLATION

1) Mount steering gear case to body and tighten gear case mount bolts to specified torque.

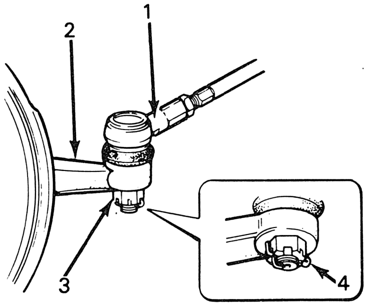
25 N·m (18.0 lb. ft.)

1. CAR BODY
2. STEERING GEAR CASE
3. CASE MOUNT BOLT
4. PINION SIDE BRACKET
5. RACK SIDE BRACKET



2) Install tie rod ends to knuckles (R & L). Tighten each castle nut until holes for split pin align but within specified torque and then bend split pin as shown.

1. TIE ROD END
2. KNUCKLE
3. CASTLE NUT
4. SPLIT PIN



43 N·m (32.0 lb. ft.)

3) Be sure that steering wheel and brake discs (R & L) are all straightahead driving state and then insert steering lower joint into steering pinion shaft.
4) Tighten steering shaft joint bolts to specified torque (Lower side first and then upper side).

1. UPPER JOINT BOLT
2. LOWER JOINT BOLT

25 N·m (18.0 lb. ft.)

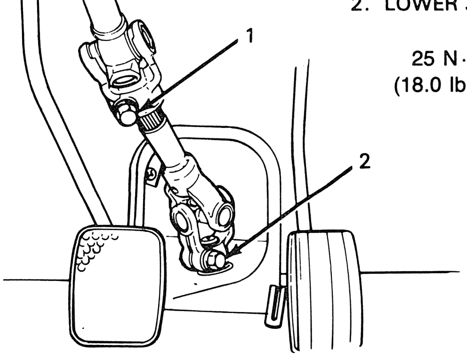
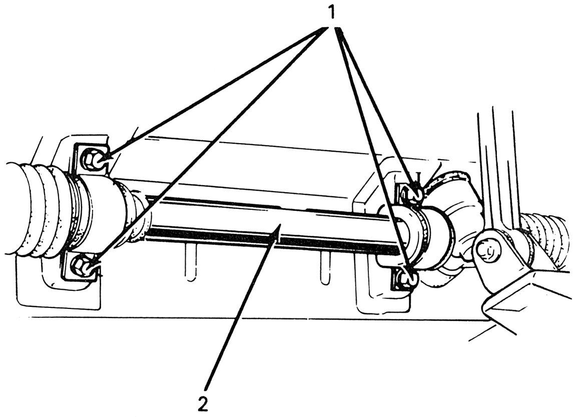


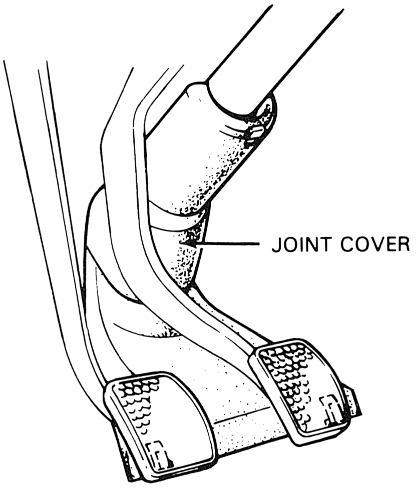
Figure 3B-4 - Manual Rack and Pinion Assembly A

8) Remove steering gear case mount bolts, gear case brackets and then gear case.



1. GEAR CASE MOUNT BOLT
2. STEERING GEAR CASE

5) Reinstall cover removed previously to steering shaft joint.



6) Put back floor mat as it was.
7) Install both front wheels (Refer to WHEEL Section 3E) and tighten wheel nuts to specified torque:

N·m	lb. ft.
60	44.0

8) Lower hoist.
9) Check toe setting. Adjust as required (Refer to FRONT END ALIGNMENT Section 3A).
10) Tighten both tie rod end lock nuts to specified torque.

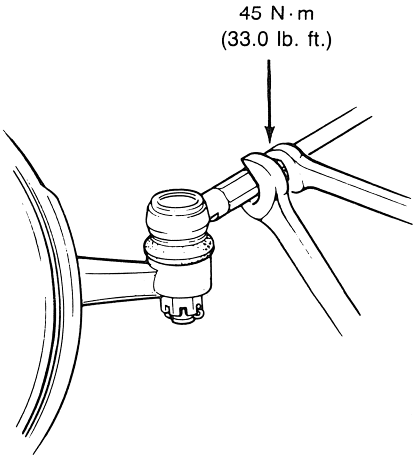
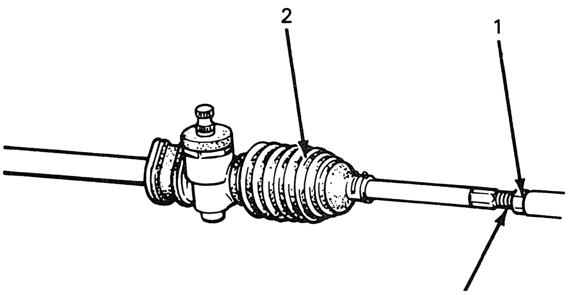


Figure 3B-5 - Manual Rack and Pinion Assembly B

3. REMOVE AND INSTALL RACK BOOT/TIE ROD

REMOVAL

1) Remove steering gear case by performing steps 1) - 8) in Item 2 MANUAL RACK AND PINION REMOVAL of this section.
2) For ease of adjustment after installation, make marking of tie rod end lock nut position on tie rod thread.

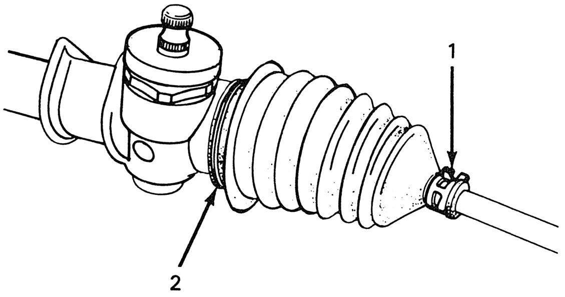


MAKE MARKING HERE.

1. LOCK NUT 2. BOOT

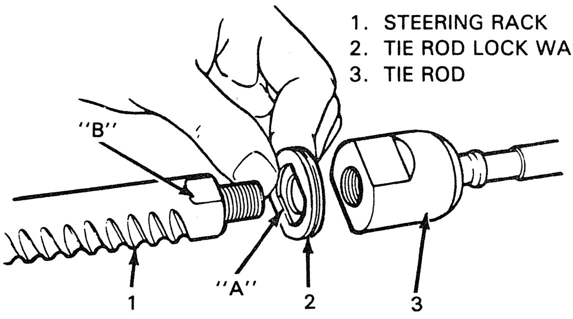
3) Loosen tie rod end lock nut and remove tie rod end.
4) Remove boot wire and clip.

1. CLIP
2. WIRE



INSTALLATION

1) Install tie rod lock washer and tie rod to rack. Align straight part "A" of washer with flat part "B" of rack.

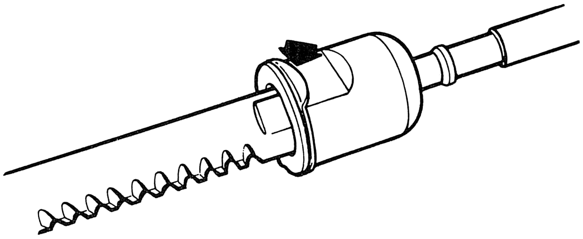


1. STEERING RACK
2. TIE ROD LOCK WASHER
3. TIE ROD

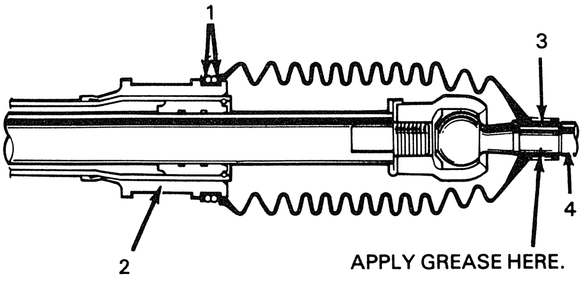
2) Tighten tie rod inside ball nut to specified torque:

N·m	lb. ft.
85	63.0

3) Bend lock washer to tie rod side.



4) Position boot properly in grooves of gear case and tie rod and clamp it with wire and clip.
Wire should be new and should go around twice and be tightened with its both ends twisted together. The twisted ends should be bent in the circumferential direction. After this, check to ensure that boot is free from twist and dent.

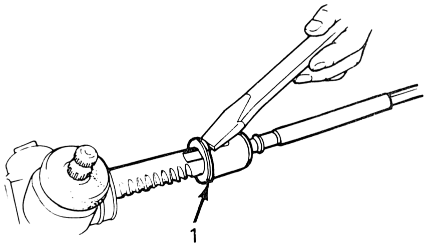


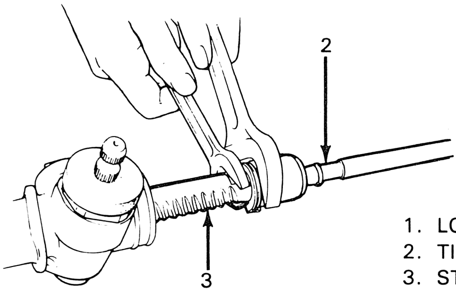
APPLY GREASE HERE.

1. WIRE
2. RACK SIDE MOUNT
3. CLIP
4. TIE ROD

Figure 3B-6 - Rack Boot and Tie Rod

5) Remove boot from tie rod.
6) Unbend bent part of tie rod lock washer and remove tie rod from rack.

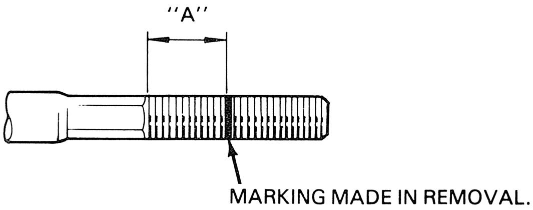




1. LOCK WASHER
2. TIE ROD
3. STEERING RACK

5) Install tie rod end lock nut and tie rod end to tie rod. Position lock nut to marking made in removal.

NOTICE:
When tie rod was replaced, measure length "A" on removed tie rod and use it on new replacement tie rod so as to position lock nut properly.

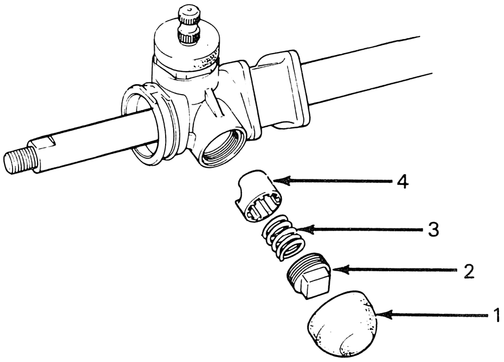


6) For installation procedures following the above, refer to steps 1) — 10) in Item 2, INSTALLATION STEERING GEAR CASE of this section.

4. REMOVE AND INSTALL STEERING RACK PLUNGER

REMOVAL

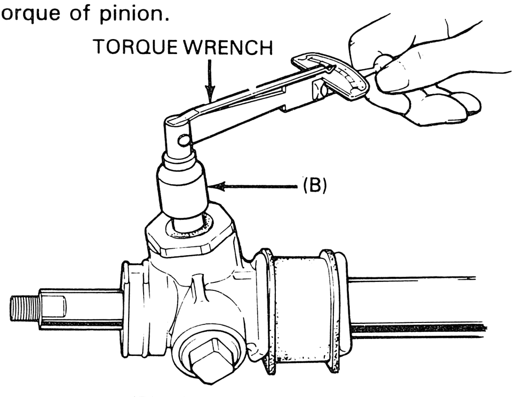
1) Remove parts as shown.



1. RACK DAMPER SCREW CAP
2. RACK DAMPER SCREW
3. RACK PLUNGER SPRING
4. RACK PLUNGER

INSTALLATION

1) Apply grease lightly to sliding part of plunger against rack.
2) Install parts as shown.
3) After tightening rack damper screw to the tightest point, turn it back by 0 ~ 90 ° and check for rotation torque of pinion.



(B): SPECIAL TOOL
(PINION TORQUE CHECKING SOCKET J34871)

Also, check if rack as a whole moves smoothly.

Pinion torque:

N·m	lb. ft.
1.2	0.80

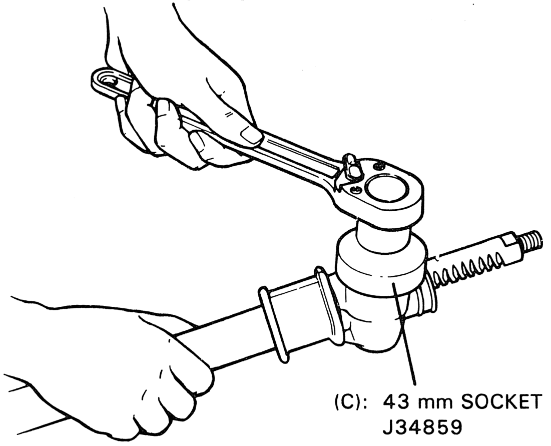
4) After adjustment, put rack damper screw cap as deeply as possible.

Figure 3B-7 - Rack Boot, Tie Rod and Plunger

5. REMOVE AND INSTALL STEERING PINION

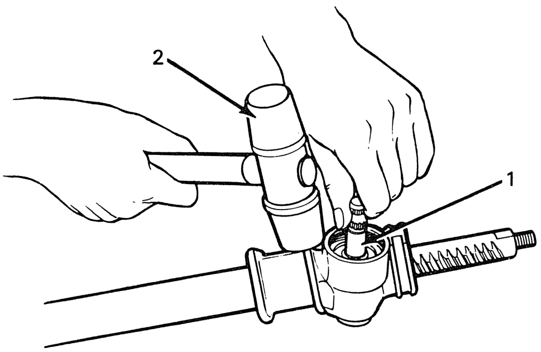
REMOVAL

1) Remove rack and plung as shown in 4. Remove and install steering rack plunger.
2) Remove gear case packing.
3) Remove bearing plug with special tool (C).

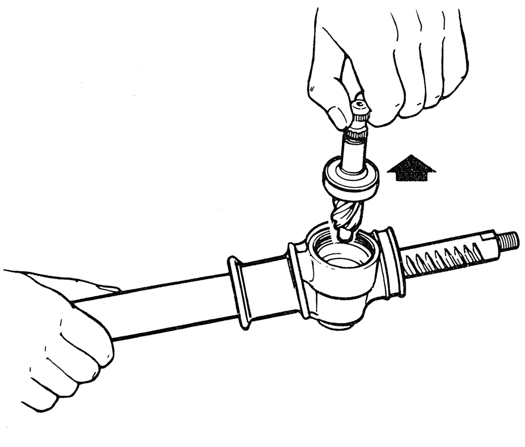


4) Tap on position as shown with plastic hammer to separate pinion assembly from housing.

1. PINION
2. PLASTIC HAMMER



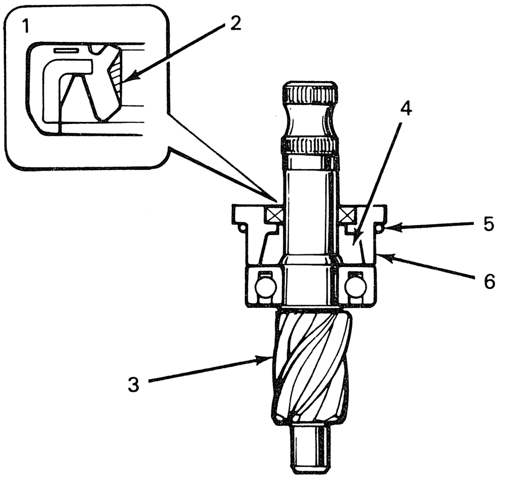
5) Remove pinion assembly.



INSTALLATION

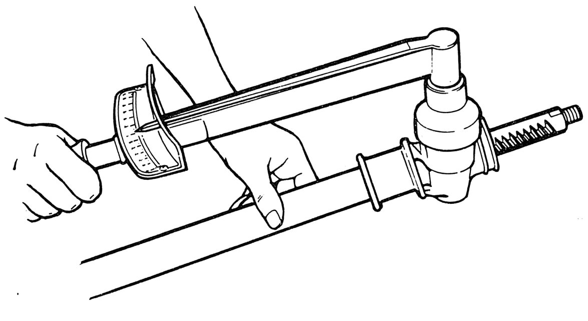
1) Apply grease to all around pinion teeth, pinion needle bearing and gear case oil seal lip.

1. GEAR CASE OIL SEAL
2. GREASING POINT
3. PINION TEETH
4. FILL INSIDE OF PINION BEARING PLUG WITH GREASE.
5. GEAR CASE O-RING
6. APPLY LOCTITE TO PINION BEARING PLUG THREAD.



2) Install pinion assembly.
3) Tighten pinion bearing plug to specified torque:

N·m	lb.-ft.
95	70.0



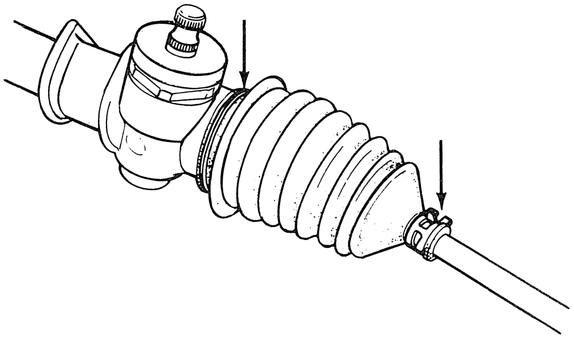
4) Install gear case packing.
5) Install rack plunger as shown in 4. Remove and install steering rack plunger.

Figure 3B-8 - Steering Pinion

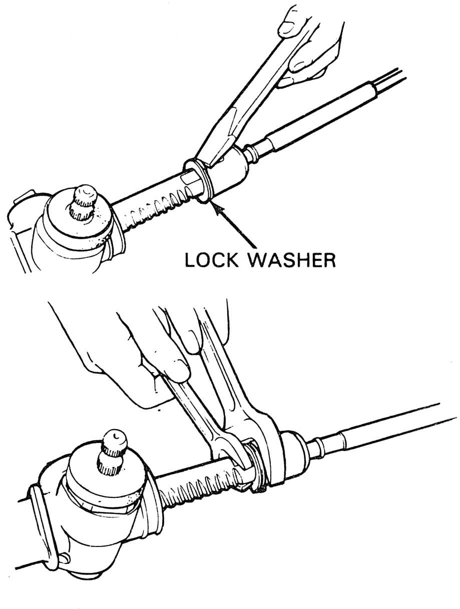
6. REMOVE AND INSTALL STEERING RACK

REMOVAL

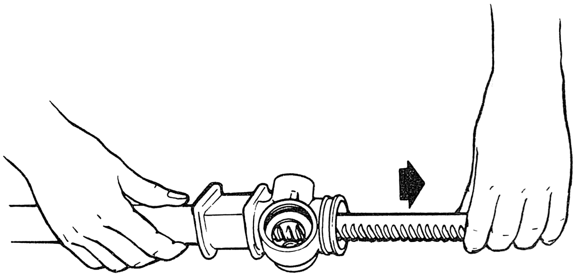
1) Remove boot wires and clips.



2) Move both boots toward tie rod end.
3) Unbend bent part of tie rod lock washers and remove tie rods from right and left sides of steering rack.
4) Mark left and right tie rods accordingly.



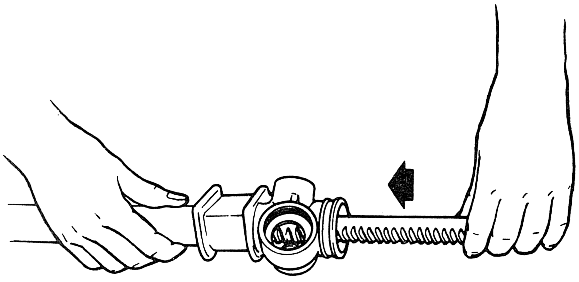
5) Remove rack plunger and pinion assembly from gear case by performing steps 1) – 5) in Item 5 STEERING PINION REMOVAL of this section.
6) Remove rack from gear case. Direction for rack removal is as shown below.



INSTALLATION

1) Apply grease to entire teeth surface of rack and its periphery.
2) Slide rack into steering gear case in the direction as shown.

CAUTION: Inside of steering rack bushing is coated with special coating. As it is damageable, be careful not to cause damage to it when inserting rack into steering gear case.



3) Install pinion assembly to gear case by performing steps 1) – 4) in Item 5 STEERING PINION INSTALLATION of this section.
4) Perform steps 1) – 4) in Item 4 STEERING RACK PLUNGER INSTALLATION of this section.
5) Before installing boot to steering rack housing, make sure that rack side mount is positioned as shown below. Install tie rods to rack by performing steps 1) – 6) in Item 3 RACK BOOT/TIE ROD of this section.

1 STEERING RACK HOUSING
2 RACK SIDE MOUNT

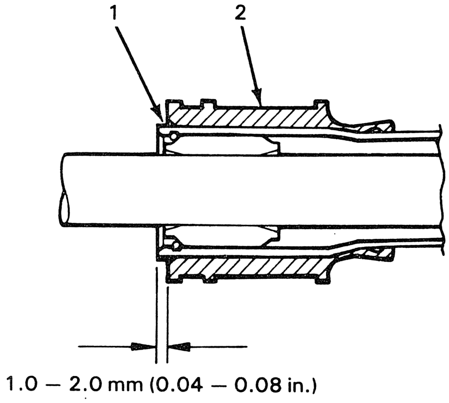


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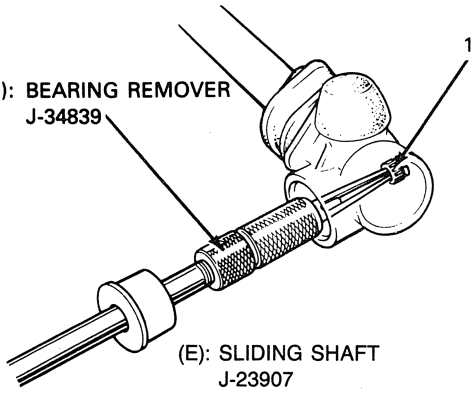
Figure 3B-9 - Steering Rack

7. REMOVE AND INSTALL PINION BEARING

REMOVAL

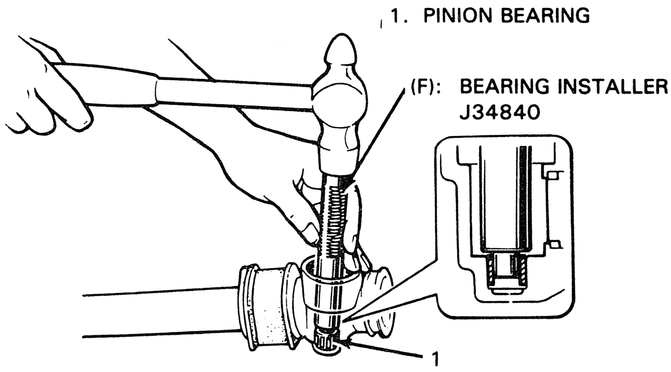
1) Remove rack from steering gear case, referring to Item 6 STEERING RACK REMOVAL of this section.
2) Pull out pinion bearing from gear case with special tools (D and E) as shown.


1
(D): BEARING REMOVER
J-34839
(E): SLIDING SHAFT
J-23907

1. PINION BEARING

INSTALLATION

1) Apply grease to rollers of pinion bearing.
2) Press-fit pinion bearing into gear case with special tool (F) as shown.
After press-fitting, make sure that bearing rollers are installed properly.


1. PINION BEARING
(F): BEARING INSTALLER
J34840
1

3) Follow steps 1) — 5) in Item 6 STEERING RACK INSTALLATION of this section to complete installation.

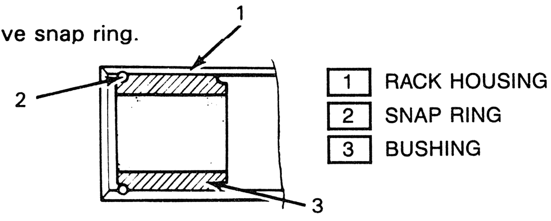
8. REMOVE AND INSTALL RACK BUSHING

REMOVAL

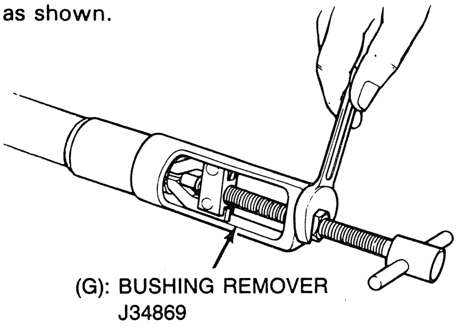
1) Remove rack from steering gear case, referring to Item 6 STEERING RACK REMOVAL of this section.

NOTICE:
When removing the rack bushing, be careful not to pull out the bushing by holding the gear case in a vise. Or the housing (pipe) may come off the gear case. For this work, be sure to use the below specified special tool.

2) Remove snap ring.


1
2
3
1 RACK HOUSING
2 SNAP RING
3 BUSHING

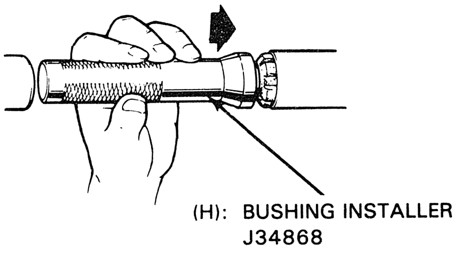
3) Pull out bushing from rack housing with special tool (G) as shown.

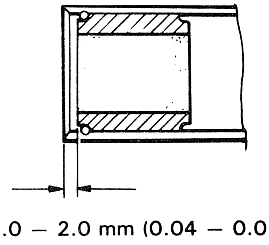

(G): BUSHING REMOVER
J34869

INSTALLATION

1) Apply grease lightly to entire inner surface of bushing.
2) Press-fit bushing as far into rack housing as shown below by using special tool (H).

CAUTION: Inside of bushing is coated with special coating. As it is damageable, be sure to use special tool and special care not to cause damage to inside of bushing when press-fitting it.


(H): BUSHING INSTALLER
J34868


1.0 — 2.0 mm (0.04 — 0.08 in.)

3) Install snap ring.
4) Follow steps 1) — 5) in Item 6 STEERING RACK INSTALLATION of this section to complete installation.

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Figure 3B-10 - Pinion Bearing and Rack Bushing

RACK AND PINION INSPECTION

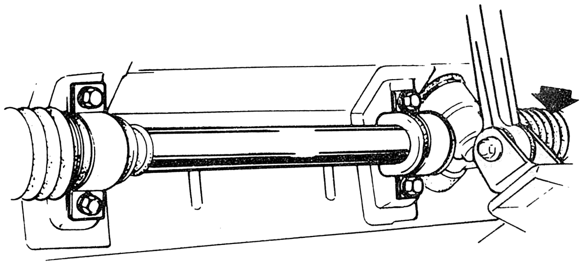
Boots should be visually inspected for any damage and tear during every periodical inspection at specified intervals and whenever car is hoisted for some other reason.

STEERING RACK BOOTS

Hoist car.

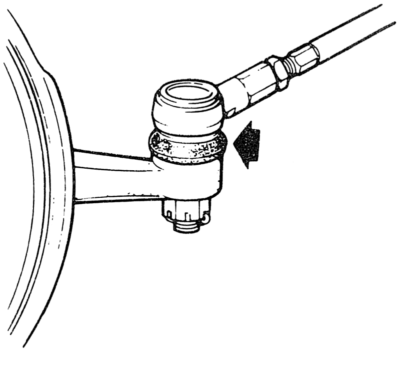
Inspect each boot for tear. A torn boot allows entry of dust and water which can cause wear to steering rack and pinion to produce noise as well as rust to result in malfunction of steering system.

If even a small tear is noted, replace with new one.



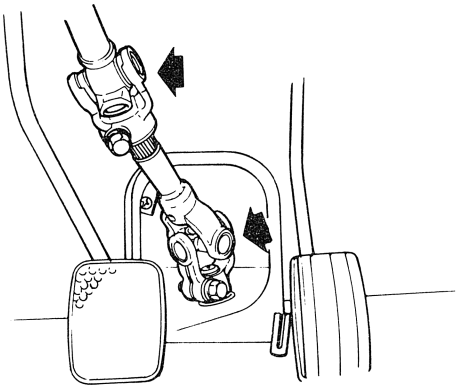
TIE ROD END BALL STUD DUST SEAL

Inspect the dust seal for breakage. If even a small fissure is found, replace the dust seal with a new one. Previous to the installation of new dust seal, fill it with the specific grease furnished together with the new dust seal.



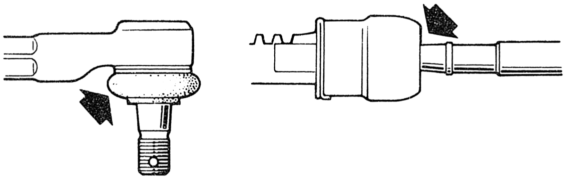
STEERING SHAFT JOINT

Check shaft joint for wear, breakage and other damage and replace if any defect exists.



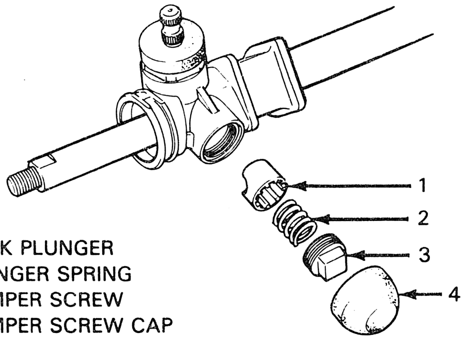
TIE ROD END

1) Inspect for play in ball joint.
2) Inspect for play in rack end ball joint.
   In either case, if found defective, replace.



RACK PLUNGER

1) Inspect for wear or damage.
2) Inspect rack plunger spring for deterioration.
   In either case, if found defective, replace.

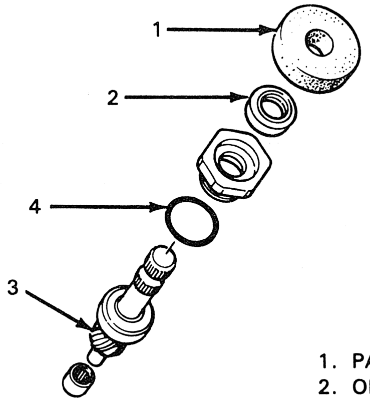


1. RACK PLUNGER
2. PLUNGER SPRING
3. DAMPER SCREW
4. DAMPER SCREW CAP

Figure 3B-11 - Rack and Pinion Inspection

STEERING PINION

1) Inspect pinion teeth surface for wear or damage.
2) Inspect oil seal for damage.
3) Inspect gear case packing for damage.
   Replace any part found defective.



1. PACKING
2. OIL SEAL
3. STEERING PINION
4. CASE SEAL

STEERING PINION BEARING

Check the rotation condition of the bearing and inspect for wear.

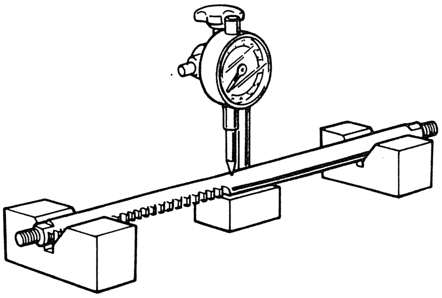
If found defective, replace.

STEERING RACK

Inspect for deflection, teeth wear, or damage, back surface wear or damage.

Limit on rack deflection	0.40 mm (0.016 in.)

If deflection exceeds limit, replace rack.

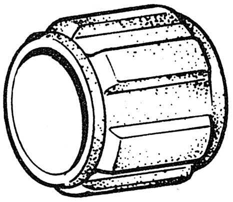


Do not use a wire brush when cleaning.

STEERING RACK BUSHING

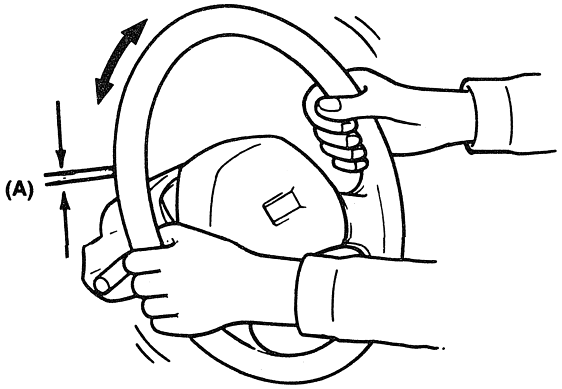
Inspect rack bushing for wear or damage.

If found defective, replace.



Check steering wheel for play and rattle, holding car in straight forward condition on the ground.

Steering wheel play (A)	0 – 30 mm (0 – 1.2 in.)



If steering wheel play is not within specification, inspect as follows and replace if found defective.

- Tie-rod end ball stud for wear (ball stud should move when more than 2 kg-cm torque is applied.)
- Lower ball joint for wear
- Steering shaft joint for wear
- Steering pinion or rack gear for wear or breakage
- Each part for looseness

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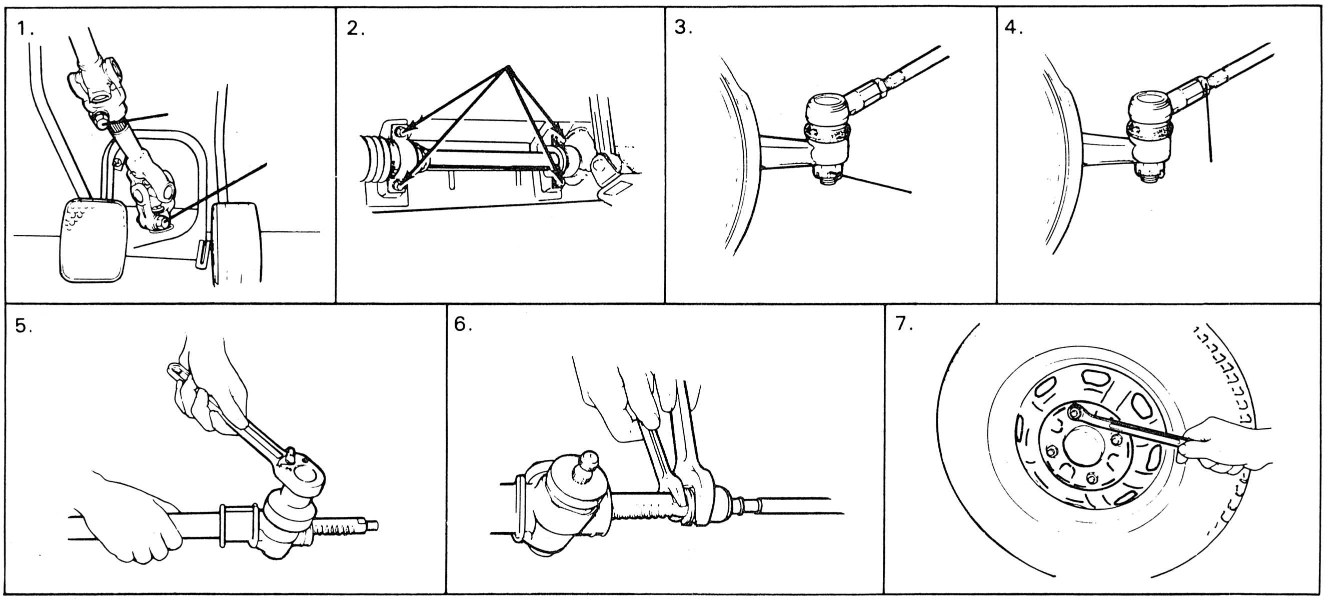
Figure 3B-12 - Pinion, Pinion Bearing, Rack and Rack Bushing

RECOMMENDED TORQUE SPECIFICATIONS

Fastening parts	Tightening torque	
	N·m	lb. ft.
1. Steering shaft joint bolts	25	18.0
2. Steering gear case bolts	25	18.0
3. Tie-rod end castle nuts	43	32.0
4. Tie-rod end lock nuts	45	33.0
5. Steering pinion bearing plug	95	70.0
6. Tie-rod	85	63.0
7. Wheel nut	60	44.0
8. Pinion	1.2	0.80

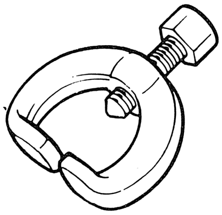


REQUIRED SERVICE MATERIAL

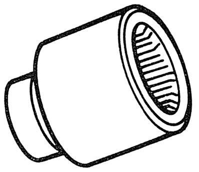
MATERIAL	USE
GM Manual Steering Gear Lube #1052182	• Sliding part of rack against steering housing (All around rack plunger, rack bushing and rack) • Sliding part against steering pinion (Oil seal lip, Needle bearing) • Steering rack and pinion gear teeth • Filled into pinion bearing cap • Contacting parts of tie rod and rack side boots • Rack end ball joint
GM Loctite Thread Locking Kit #1052624	• Pinion Bearing Plug Thread

Figure 3B-13 - Specifications and Service Materials

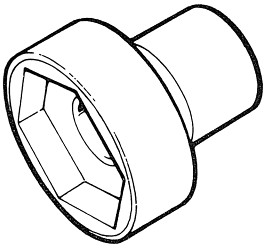
SPECIAL TOOLS



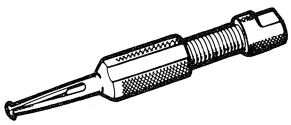
J21687-02
Tie-rod end remover



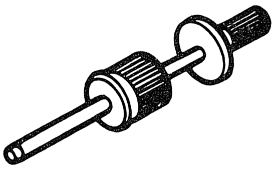
J34871
Pinion torque checking socket



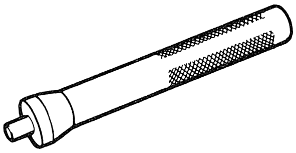
J34859
43 mm Socket
Pinion bearing plug socket



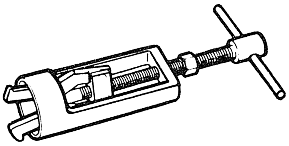
J34839
Pinion bearing remover



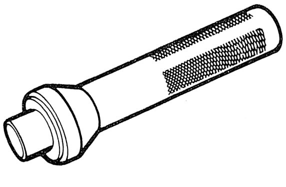
J23907
Slide hammer



J34840
Pinion bearing installer



J34869
Rack bushing remover



J34868
Rack bushing installer

Figure 3B-14 - Special Tools

SECTION 3C

FRONT SUSPENSION

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GENERAL DESCRIPTION

The front suspension is the strut type independent suspension. The upper end of a strut is anchored to the car body by a strut support. The strut and strut support are isolated by a rubber mount. A strut bearing is also installed a little lower to the rubber mount.

The lower end of the strut is connected to the upper end of the steering knuckle. The lower end of the knuckle is attached to the ball joint, which is attached to the suspension control arm.

Movement of the steering wheel is transmitted to the tie rod end and then to the knuckle, causing the wheel-and-tire to move. With the movement of the knuckle, the strut also rotates by means of the strut bearing and lower ball joint (Figure 1).

ON-VEHICLE SERVICE

RIDE COMPLAINTS

If complaints of hard ride are encountered, the first items to investigate are tire pressure, trim height, and Superlift shock/strut condition. If these are correct, the amount of friction in the front suspension should be checked. For additional diagnosis, refer to STEERING, SUSPENSION, WHEELS AND TIRE DIAGNOSIS (Section 3).

EXCESSIVE FRICTION CHECK

1. With the aid of a helper, lift up on the rear bumper and raise car as high as possible. Slowly release the bumper and allow the car to assume normal trim height.
2. Measure distance from floor to center of bumper.
3. Push down on bumper, release slowly, and allow car to assume normal trim height.
4. Measure distance from floor to center of bumper.

The difference between the two measurements should be within 12.7 mm (1/2 in.) of each other. If the difference exceeds this limit, inspect the control arms, struts, and ball joints for damage or wear.

STRUT DAMPER ASSEMBLY

Figures 2 through 7

←→ Remove or Disconnect

1. Hoist vehicle, allowing front suspension to hang free.
2. Wheel.
3. E-ring securing the brake hose and then take brake hose off strut bracket.
5. Strut support nuts (Figure 5).

NOTICE: Hold strut by hand so that it will not fall off.

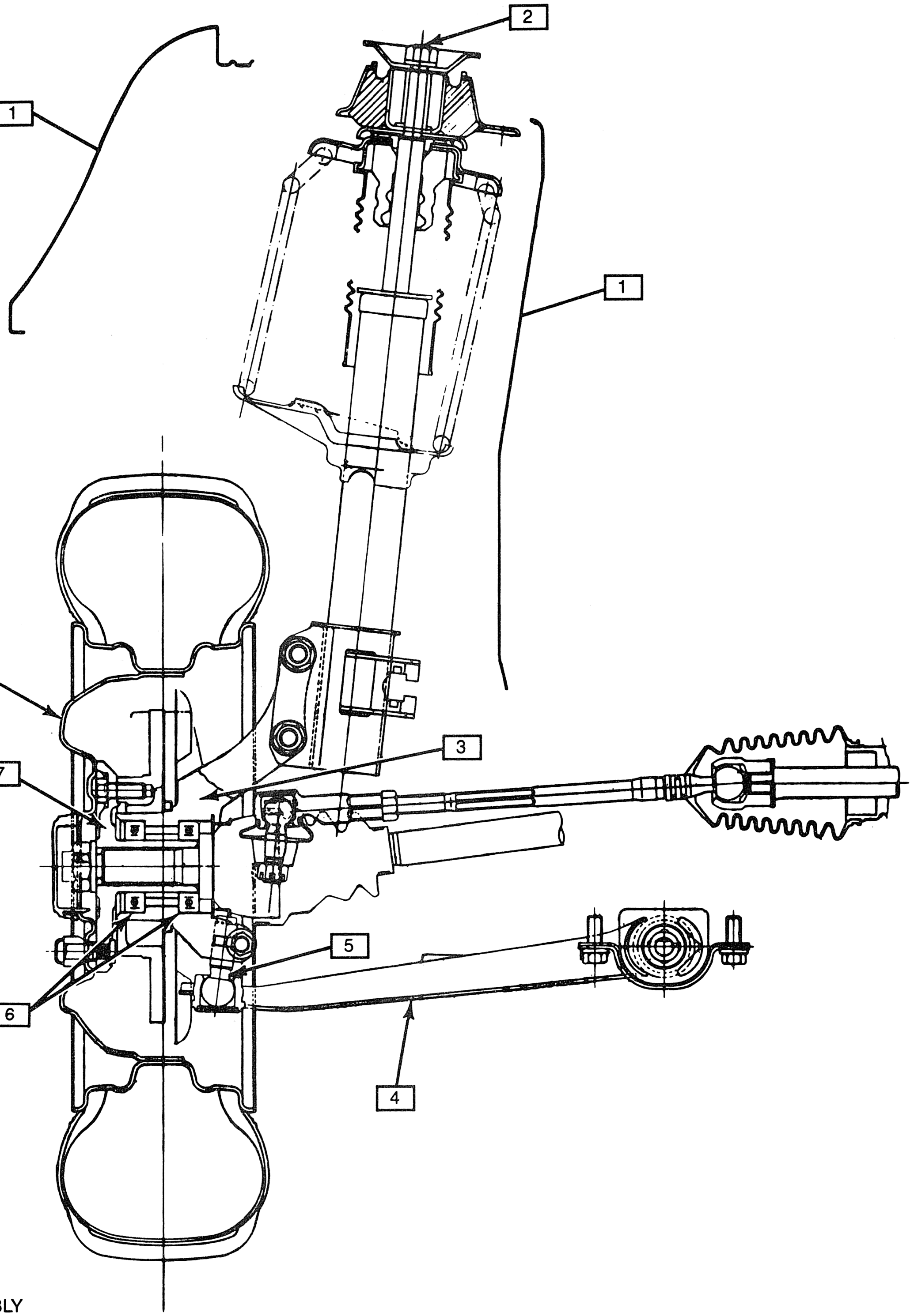
6. Strut assembly.

→← Install or Connect

1. Place strut in position for installation.
2. Strut support nuts (Figure 6).
3. Strut bracket bolts (Figure 6).
4. Brake hose to strut bracket and install E-ring.
5. Wheel.
6. Lower vehicle.

Tighten

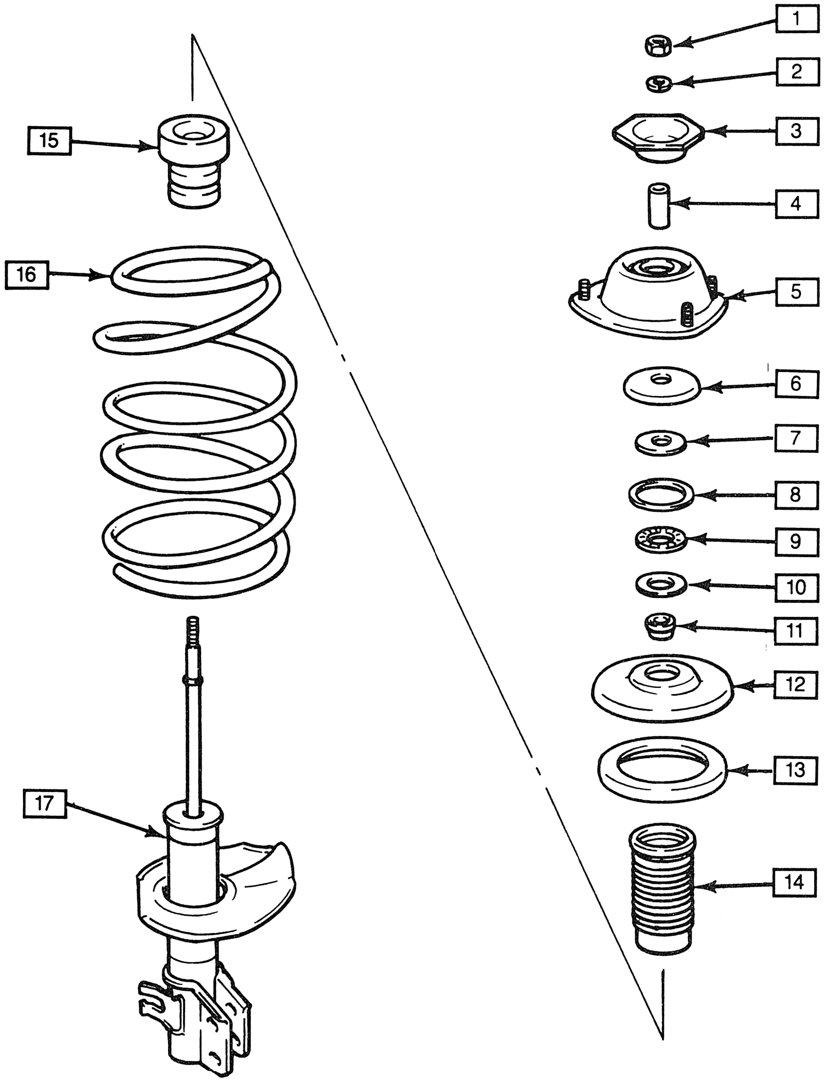
- Strut support nuts to 27 N·m (20.0 lb.ft.).
- Strut bracket bolts to 80 N·m (59.0 lb.ft.).


2
1
1
8
3
7
5
6
4

1	VEHICLE BODY
2	STRUT ASSEMBLY
3	STEERING KNUCKLE
4	SUSPENSION ARM (LOWER ARM)
5	BALL STUD
6	WHEEL BEARING
7	FRONT WHEEL HUB
8	WHEEL

KC0224-3C-M-RS

Figure 1 Front Suspension Cross Section



1	NUT
2	WASHER
3	STOPPER
4	INNER SPACER
5	SUPPORT COMP.
6	BEARING SEAT
7	BEARING UPPER WASHER
8	BEARING SEAL
9	BEARING
10	BEARING LOWER WASHER
11	BEARING SPACER
12	COIL SPRING UPPER SEAT
13	COIL SPRING SEAT
14	STRUT COVER
15	BUMP STOPPER
16	COIL SPRING
17	STRUT

KC0225-3C-M-RS

Figure 2 Strut Damper Assembly Exploded View

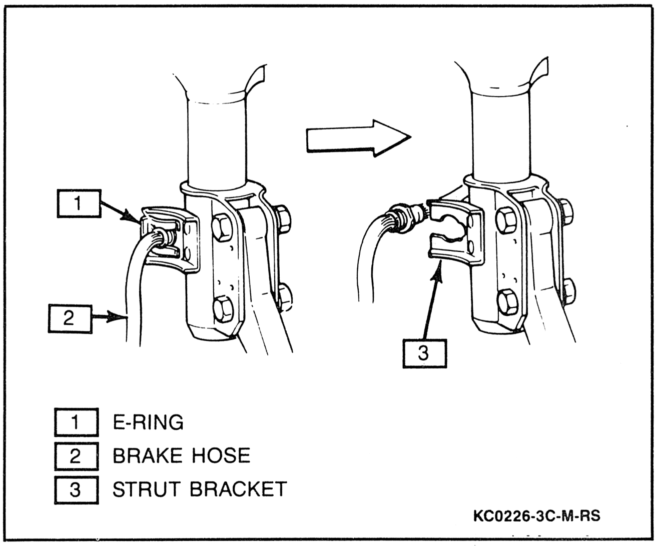

1
2
3
1 E-RING
2 BRAKE HOSE
3 STRUT BRACKET
KC0226-3C-M-RS

Figure 3 Brake Hose Removal

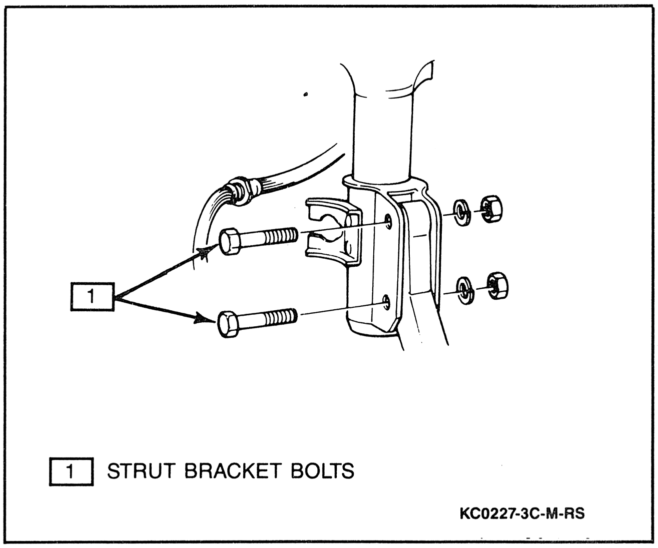

1
1 STRUT BRACKET BOLTS
KC0227-3C-M-RS

Figure 4 Strut Bracket Bolt Removal

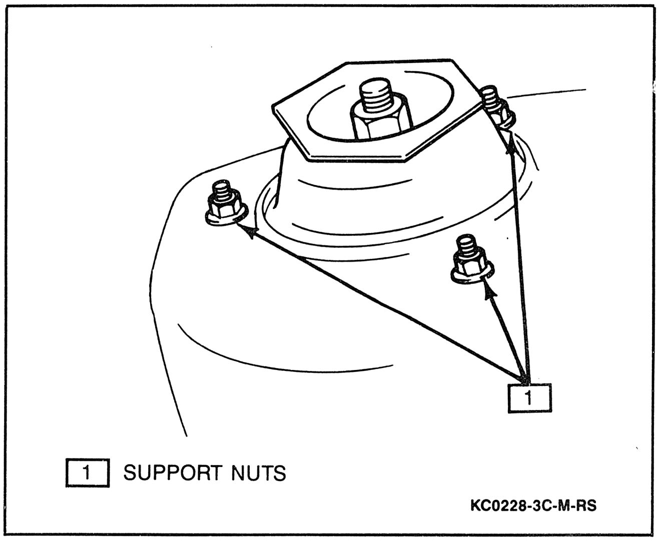

1
1 SUPPORT NUTS
KC0228-3C-M-RS

Figure 5 Strut Support Nuts

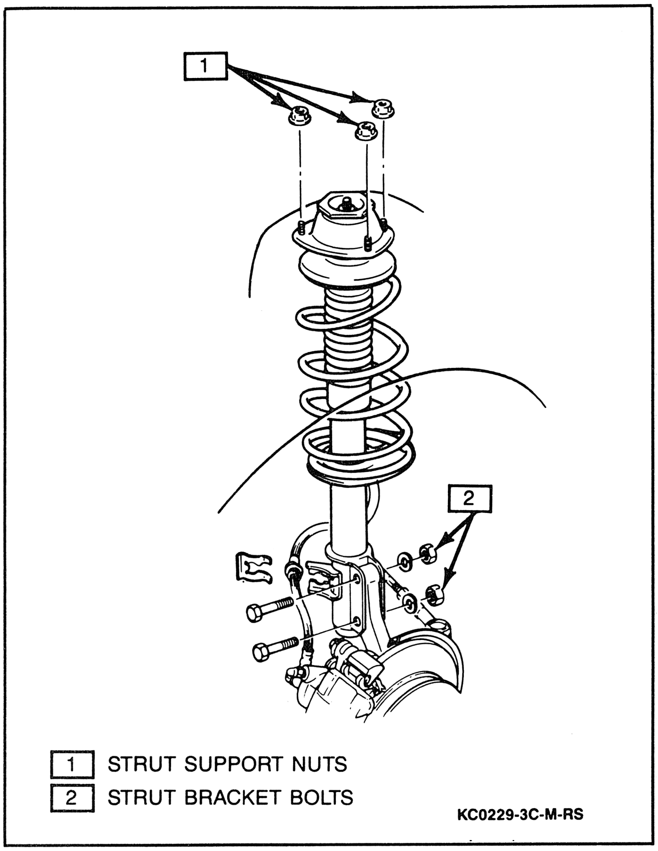

1
2
1 STRUT SUPPORT NUTS
2 STRUT BRACKET BOLTS
KC0229-3C-M-RS

Figure 6 Strut Assembly Fasteners

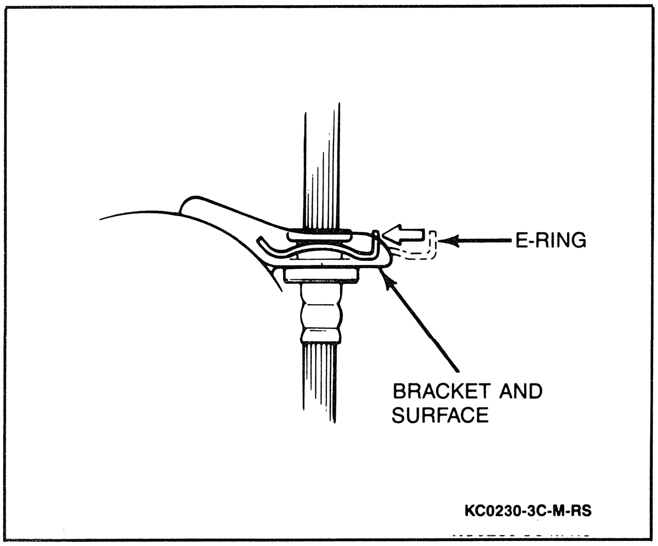

E-RING
BRACKET AND SURFACE
KC0230-3C-M-RS

Figure 7 E-Ring Installation

NOTICE: Do not twist brake hose when installing it. Install E-ring until it fits securely into bracket end surface (Figure 7).

STRUT DAMPER DISASSEMBLY AND ASSEMBLY

Figures 8 through 15

Disassemble

CAUTION: Strut springs are under high tension. Do not remove the strut

piston rod top upper support nut without using tool J34013-A Strut Compressor. Compressor.

1. Remove strut. Refer to "Strut Damper Assembly Removal" in this section.
2. Mount J34013-A Strut Compressor in J3289-20 Holding Fixture.
3. Attach strut assembly to strut compressor using both locking pins. If locking pins do not fit through holes in strut, then two 7/16" x 2" bolts with washers and nuts should be used instead (Figure 8).

NOTICE: Locking pin with clip must be used in bottom slot.

4. Turn compressor forcing screw while rotating the front strut support to properly align the mounting studs and guide them through the compressor strut hood. The mounting studs must be aligned with the correct pattern in the strut hood assembly (Figure 9).

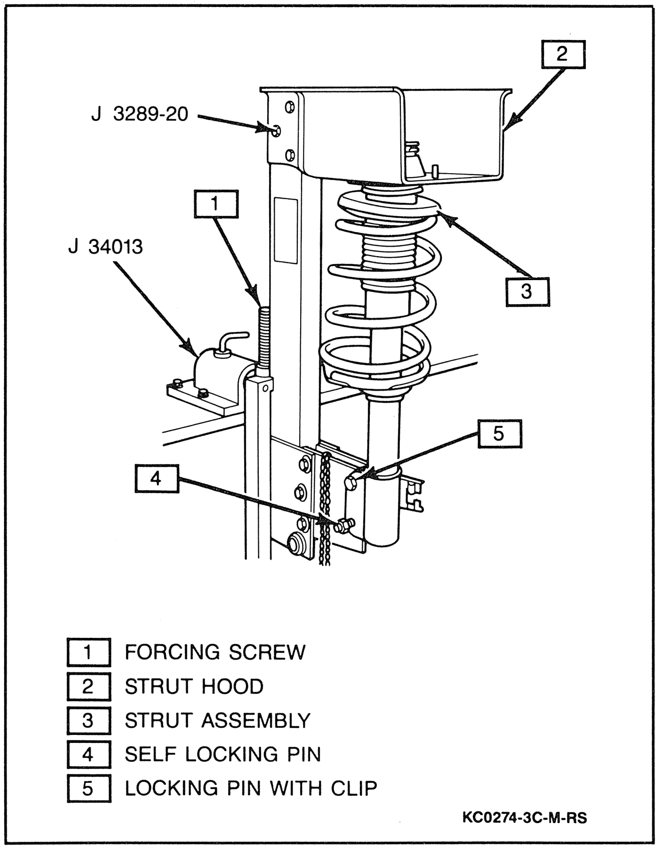

2
J 3289-20
1
J 34013
3
5
4
1 FORCING SCREW
2 STRUT HOOD
3 STRUT ASSEMBLY
4 SELF LOCKING PIN
5 LOCKING PIN WITH CLIP
KC0274-3C-M-RS

Figure 8 Strut Compressor With Strut

5. Continue turning compressor forcing screw until the strut spring compresses approximately 1/2".
6. Remove strut nut from top of strut assembly. Then remove the lock washer, spacer, and front strut stopper.
7. Place Guide Rod J34013-38 on damper shaft. Use guide rod to guide damper shaft through spring upper seat while decompressing the strut spring (Figure 10).
8. Remove strut assembly (Figure 11).

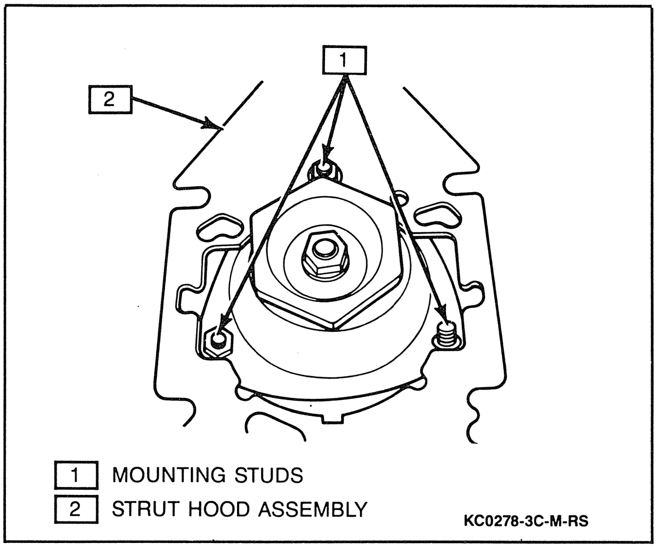

1
2
1 MOUNTING STUDS
2 STRUT HOOD ASSEMBLY
KC0278-3C-M-RS

Figure 9 Correct Mounting Stud Pattern

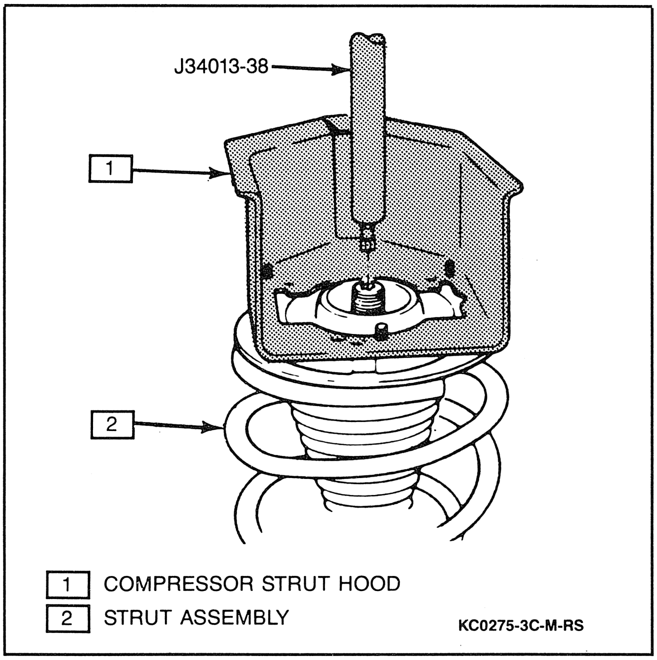

J34013-38
1
2
1 COMPRESSOR STRUT HOOD
2 STRUT ASSEMBLY
KC0275-3C-M-RS

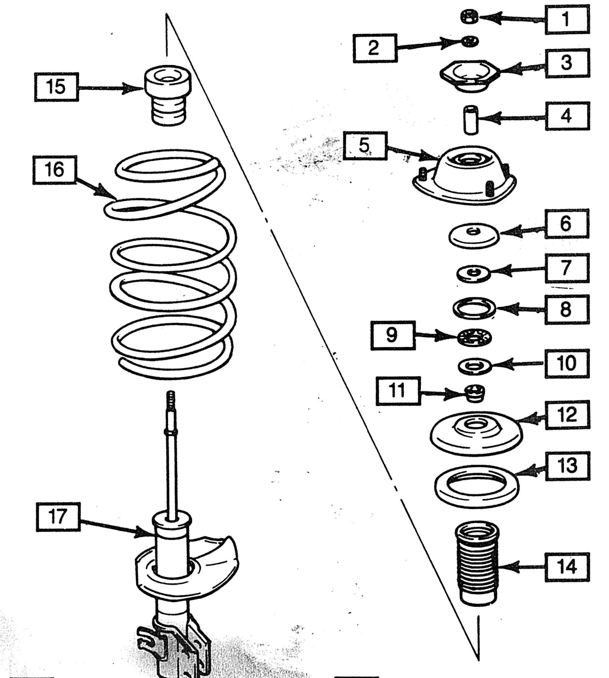
Figure 10 Strut Alignment Rod

Assemble

1. Mount J34013-A Strut Compressor in J3289-20 Holding Fixture.
2. Attach strut assembly to strut compressor using both locking pins. If locking pins do not fit through holes in strut, then two 7/16" x 2" bolts with washers and nuts should be used instead.

NOTICE: Locking pin with clip must be used in bottom slot.

3. Position spring on strut, making sure spring is properly seated on strut lower seat (Figure 12).
4. Pull up damper shaft to full extension and clamp in place with J34013-20 clamp (Figure 13).
5. Install bump stopper on shaft, then strut cover to spring seat and upper spring seat. Position arrow on upper spring seat to point outward (toward arm of fixture).


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17

1	NUT
2	WASHER
3	STOPPER
4	INNER SPACER
5	SUPPORT COMP.
6	BEARING SEAT
7	BEARING UPPER WASHER
8	BEARING SEAL
9	BEARING
10	BEARING LOWER WASHER
11	BEARING SPACER
12	COIL SPRING UPPER SEAT
13	COIL SPRING SEAT
14	STRUT COVER
15	BUMP STOPPER
16	COIL SPRING
17	STRUT

KC0232-3C-M-RS

Figure 11 Strut Assembly Exploded View

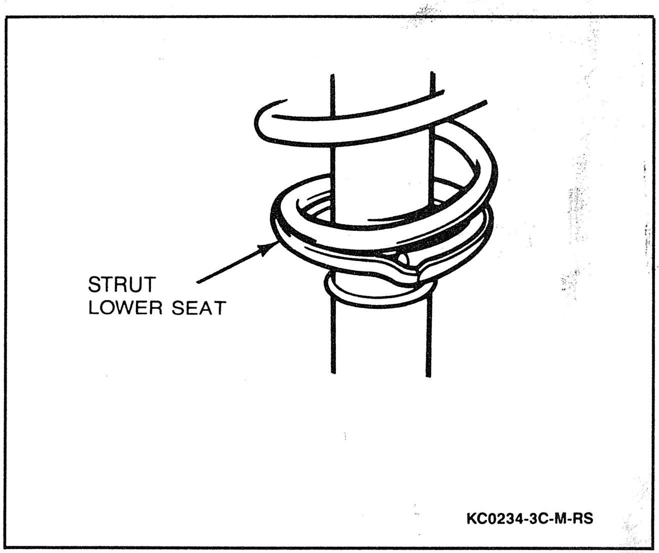

STRUT
LOWER SEAT
KC0234-3C-M-RS

Figure 12 Strut Lower Seat Position

6. Install upper mounting assembly on spring seat. Make sure they are centered and properly aligned.

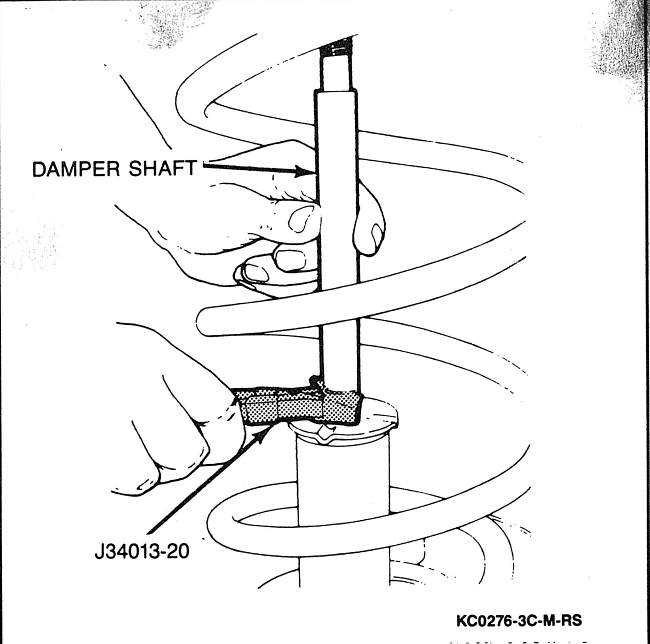
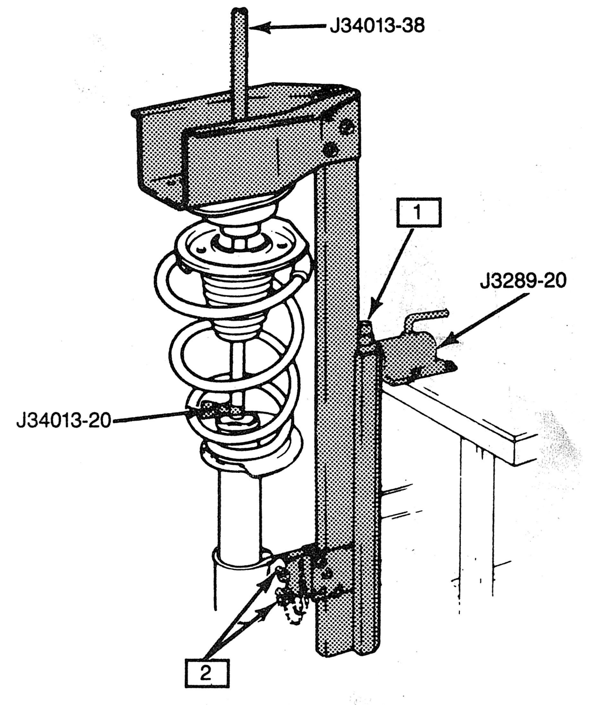

DAMPER SHAFT
J34013-20
KC0276-3C-M-RS

Figure 13 Damper Shaft Clamp Installation


J34013-38
1
J3289-20
J34013-20
2

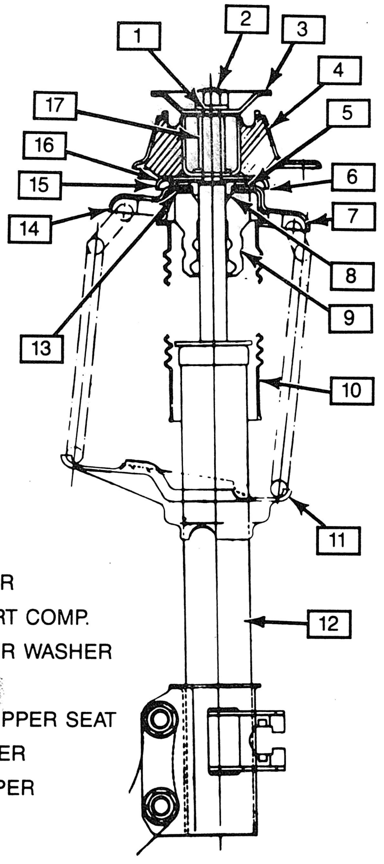
1	COMPRESSOR FORCING SCREW
2	BOTH LOCKING PINS INSTALLED

KC0277-3C-M-RS

Figure 14 Strut Alignment Rod Assembly

7. Turn compressor forcing screw while rotating the front strut support to properly align the mounting studs and guide them through the compressor strut hood. The mounting studs must be aligned with the correct pattern in the strut hood assembly.
8. Insert guide rod J34013-38 through upper strut assembly and screw it into strut damper shaft (Figure 14).

9. Compress spring by turning forcing screw while guiding the damper shaft through the upper strut assembly with the guide rod.
10. Continue compressing the spring until approximately 1" of the damper shaft is visible above the upper strut assembly.
11. Install strut to strut assembly (Figure 15).



1 LOCK WASHER
2 STRUT NUT
3 STRUT STOPPER
4 STRUT SUPPORT COMP.
5 BEARING UPPER WASHER
6 BEARING
7 COIL SPRING UPPER SEAT
8 BEARING SPACER
9 BUMPER STOPPER
10 STRUT COVER
11 COIL SPRING
12 STRUT
13 BEARING LOWER WASHER
14 COIL SPRING SEAT
15 BEARING SEAL
16 INNER SPACER
17 BEARING SEAT

KC0236-3C-M-RS

Figure 15 Strut Assembly

Tighten

- Strut nut to 50 N·m (37.0 lb.ft.).

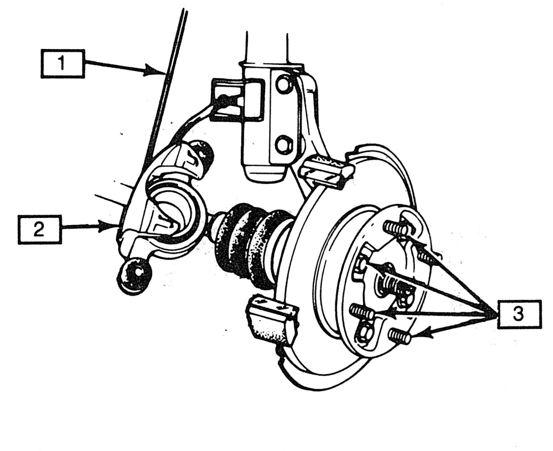
12. Remove J34013-20 Clamp.
13. Decompress spring compressor by turning the forcing screw and remove the strut assembly.

WHEEL HUB/WHEEL STUD

Figures 16 through 25

Remove or Disconnect

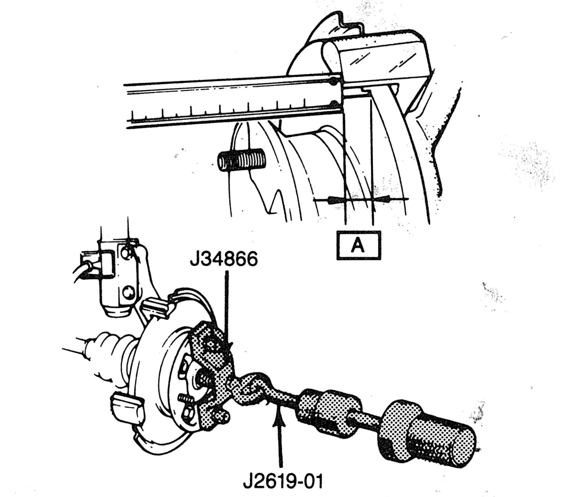
1. Hoist vehicle and remove wheel.
2. Straighten steaked portion of drive axle.



1 WIRE HOOK
2 CALIPER
3 BRAKE DISC BOLTS

KC0238-3C-M-RS

Figure 16 Caliper Removal



A NOTE DIMENSION "A" AS SHOWN BEFORE HUB REMOVAL AS AN AID IN INSTALLATION.

KC0239-3C-M-RS

Figure 17 Wheel Hub Removal

3. Depress brake pedal and hold it. Remove drive axle and loosen brake disc bolts, but don't remove them.
4. Caliper bolts (Figure 16).
5. Caliper from disc and suspend it with wire hook (Figure 16).
6. Wheel hub with special tools J34866 and J2619-01 (Figure 17).
7. Brake disc from wheel hub by first removing four disc bolts (Figure 18).
8. Wheel studs (Figure 19).

Install or Connect

1. New wheel studs on wheel hub (Figure 21).

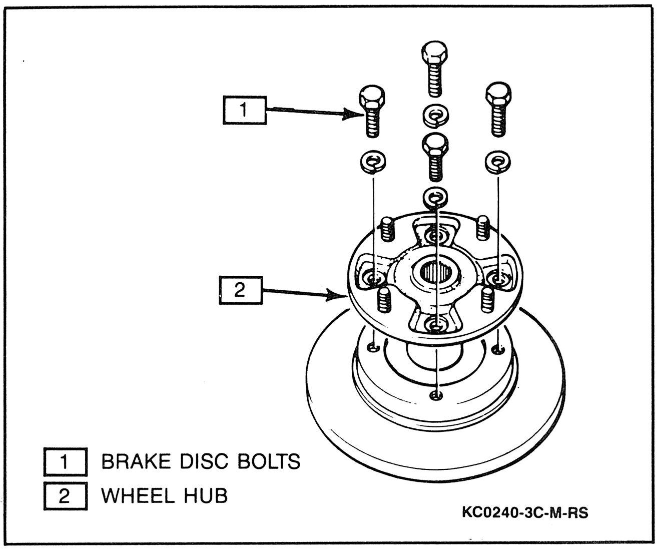

1
2
1 BRAKE DISC BOLTS
2 WHEEL HUB
KC0240-3C-M-RS

Figure 18 Brake Disc Removal

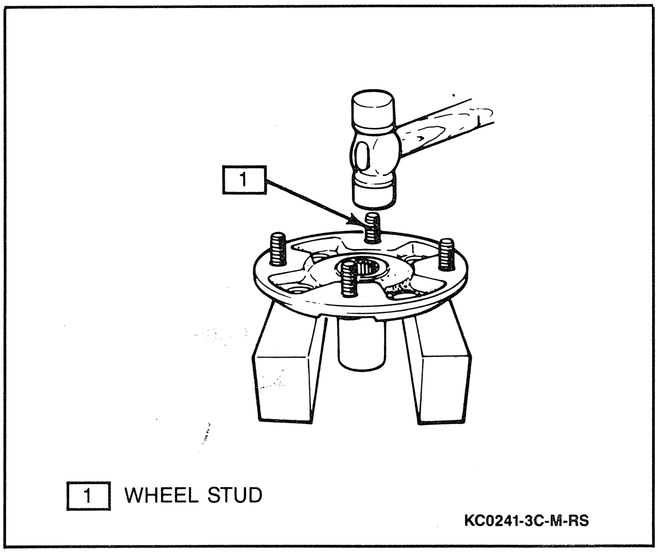

1
1 WHEEL STUD
KC0241-3C-M-RS

Figure 19 Wheel Stud Removal

NOTICE: Insert a new stud in hub hole. Rotate stud slowly to ensure the serrations are aligned with those made by original bolt.

2. Brake disc to wheel hub. Tighten disc bolts lightly.
3. Spacer to wheel hub. Note installing directions of spacer (Figure 22).

Inspect

- Visually check to ensure that bore in wheel bearing spacer which is mounted between wheel bearings in steering knuckle is aligned with inner bores of two bearings as shown. If they are offset, align them by moving spacer (Figure 23).

4. Wheel hub to knuckle as follows: First while rotating hub, tap it lightly with a plastic hammer. This is to prevent hub from being installed at an angle. After confirming that hub is free from deflection, drive it in with special tool J34856 until dimension "A" noted down before removal is attained (Figure 24).

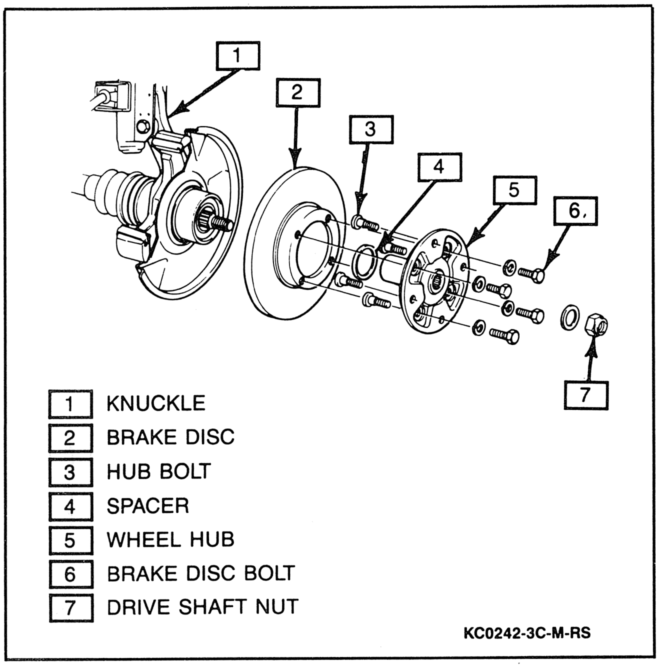

1
2
3
4
5
6
7
1 KNUCKLE
2 BRAKE DISC
3 HUB BOLT
4 SPACER
5 WHEEL HUB
6 BRAKE DISC BOLT
7 DRIVE SHAFT NUT
KC0242-3C-M-RS

Figure 20 Wheel Hub Exploded View

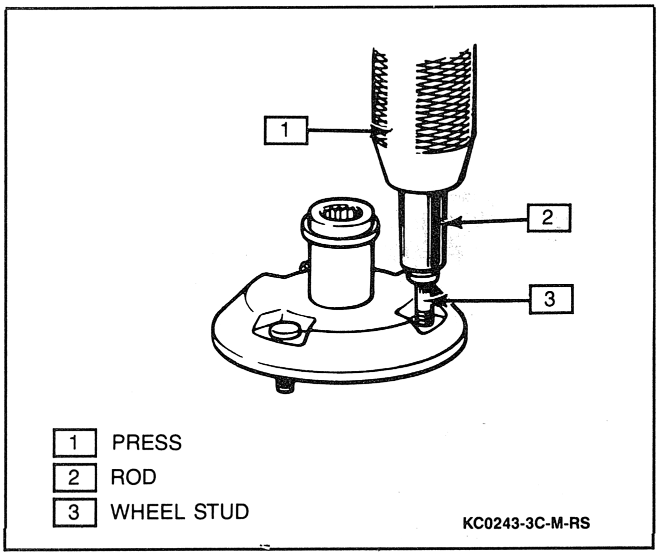

1
2
3
1 PRESS
2 ROD
3 WHEEL STUD
KC0243-3C-M-RS

Figure 21 Wheel Stud Installation

5. Pad and caliper.

Tighten

- Caliper bolts to 30 N·m (22 lb.ft.).

6. Depress brake pedal and hold it the depressed position.

Tighten

- Drive axle nut to 175 N·m (129 lb.ft.).
- Brake disc bolts to 50 N·m (37 lb.ft.).

7. Steak drive axle nut (Figure 25).

NOTICE: Removed spindle nut should be replaced with a new one.

8. Wheel.
9. Lower vehicle.

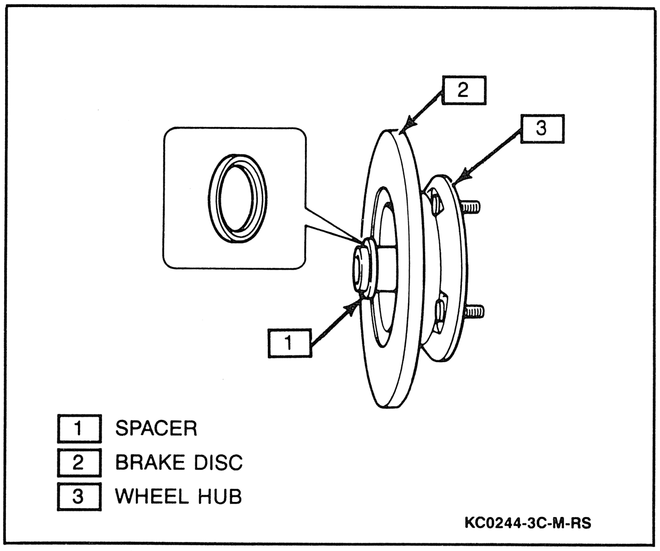

1
2
3
1 SPACER
2 BRAKE DISC
3 WHEEL HUB
KC0244-3C-M-RS

Figure 22 Wheel Hub Installation

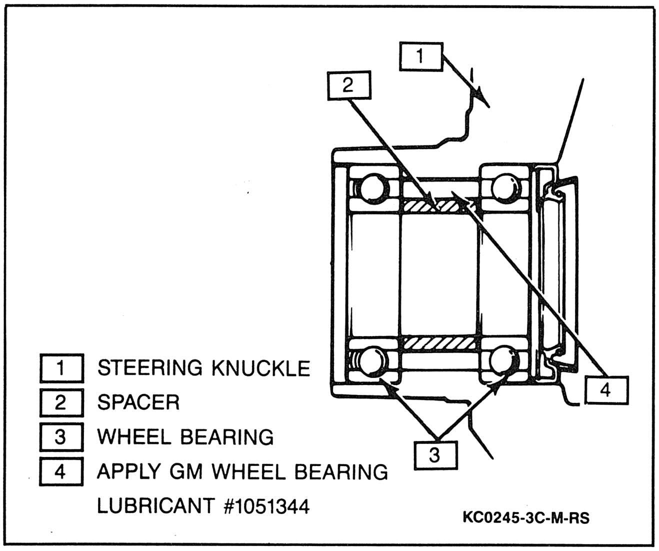

1
2
3
4
1 STEERING KNUCKLE
2 SPACER
3 WHEEL BEARING
4 APPLY GM WHEEL BEARING LUBRICANT #1051344
KC0245-3C-M-RS

Figure 23 Wheel Bearing Spacer Inspection

SUSPENSION ARM/BUSHING

Figures 27 through 34

↔ Remove or Disconnect

1. Hoist vehicle and remove wheel.
2. Ball stud bolts.
3. Suspension arm bracket nut.
4. Suspension arm bracket bolts.
5. Rear bracket and suspension arm.
6. Rear bushing with hydraulic press as shown.
7. Cut off flange of front bushing and then push out front bushing by using hydraulic press (Figures 27 and 28).

→← Install or Connect

1. Front bushing.

NOTICE: Before installing, apply soap and water on circumference of bushing to facilitate installation. When installed, bushing should be centered in arm (Figure 30).

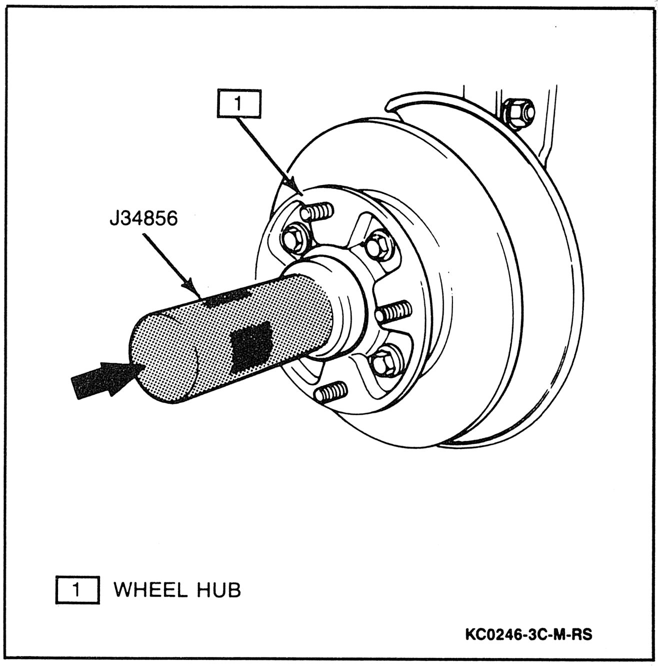

1
J34856
1 WHEEL HUB
KC0246-3C-M-RS

Figure 24 Wheel Hub to Knuckle Installation

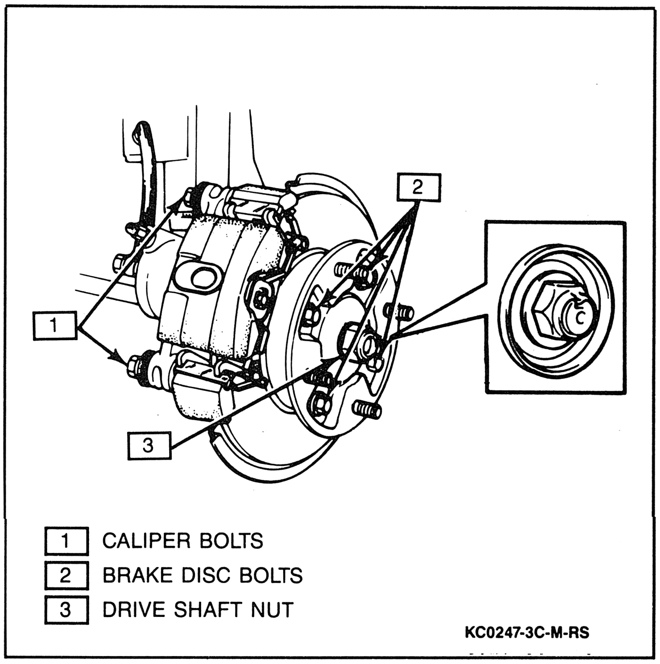

2
1
3
1 CALIPER BOLTS
2 BRAKE DISC BOLTS
3 DRIVE SHAFT NUT
KC0247-3C-M-RS

Figure 25 Wheel Hub Assembly Nuts and Bolts

2. Rear bushing to suspension arm as follows:
   - Push in rear bushing (Figure 31).
   - Drive bushing into position (Figure 32).
3. Position suspension arm bracket to suspension arm in forward direction and hand tighten bracket nut (Figure 34).
4. Suspension arm bracket to body and hand tighten bracket bolt.
5. Ball stud to knuckle. Align ball stud groove with knuckle bolt hole. Drive in ball stud bolt and install washer and nut (Figure 33).
6. Suspension arm rear bracket (Figure 34).

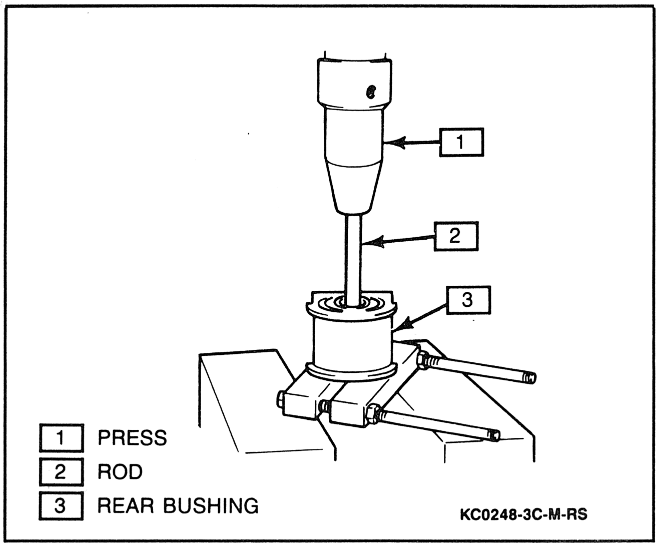

1
2
3
1 PRESS
2 ROD
3 REAR BUSHING
KC0248-3C-M-RS

Figure 26 Rear Bushing Removal

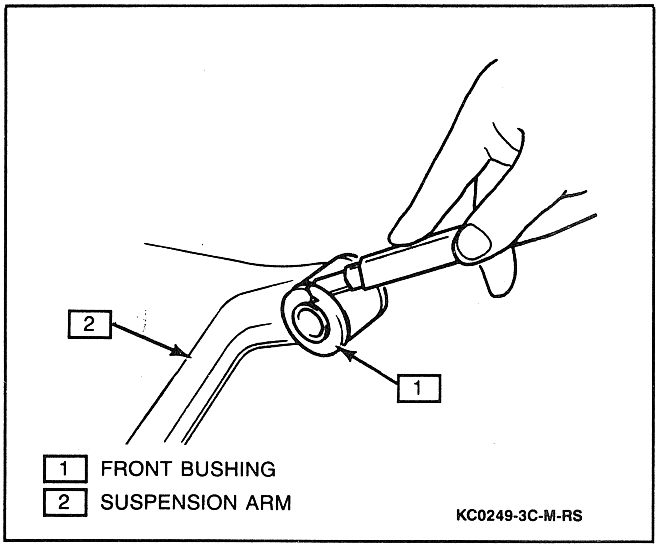

2
1
1 FRONT BUSHING
2 SUSPENSION ARM
KC0249-3C-M-RS

Figure 27 Front Bushing Flange

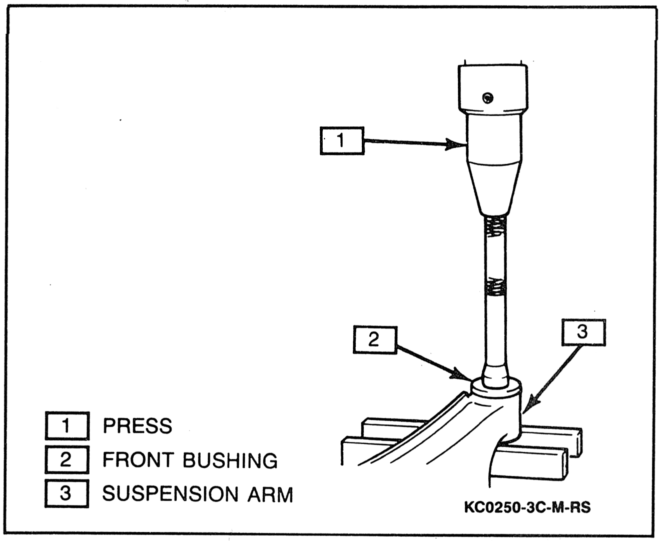

1
2
3
1 PRESS
2 FRONT BUSHING
3 SUSPENSION ARM
KC0250-3C-M-RS

Figure 28 Front Bushing Removal

Tighten

- Ball stud nut to 60 N·m (44 lb.ft.).

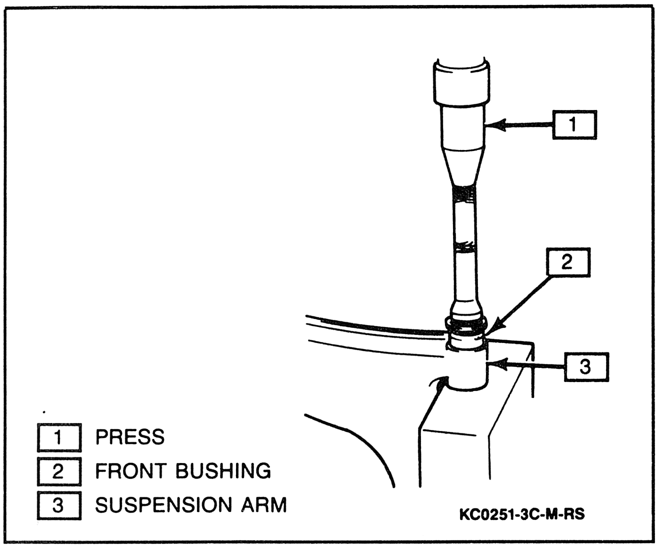

1
2
3
1 PRESS
2 FRONT BUSHING
3 SUSPENSION ARM
KC0251-3C-M-RS

Figure 29 Bushing Installation

- Suspension arm rear bracket bolts to 43 N·m (32 lb.ft.).
- Suspension arm bracket bolt to 80 N·m (59 lb.ft.).
- Bracket nut to 100 N·m (74 lb.ft.).

7. Wheel.
8. Lower vehicle.

Inspect

- Toe and adjust as required. Removal

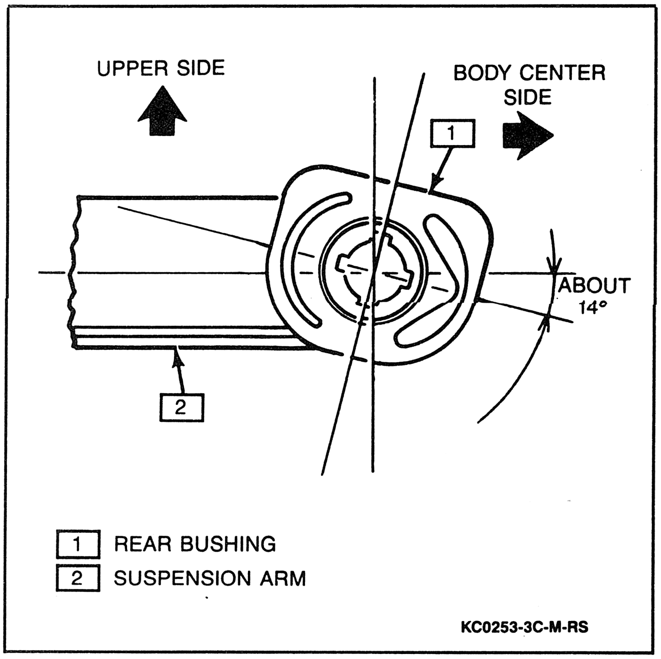

UPPER SIDE
BODY CENTER SIDE
1
ABOUT 14°
2
1 REAR BUSHING
2 SUSPENSION ARM
KC0253-3C-M-RS

Figure 31 Rear Bushing Installation

KNUCKLE

Figures 35 through 39

Remove or Disconnect

1. Hoist vehicle and remove wheel.

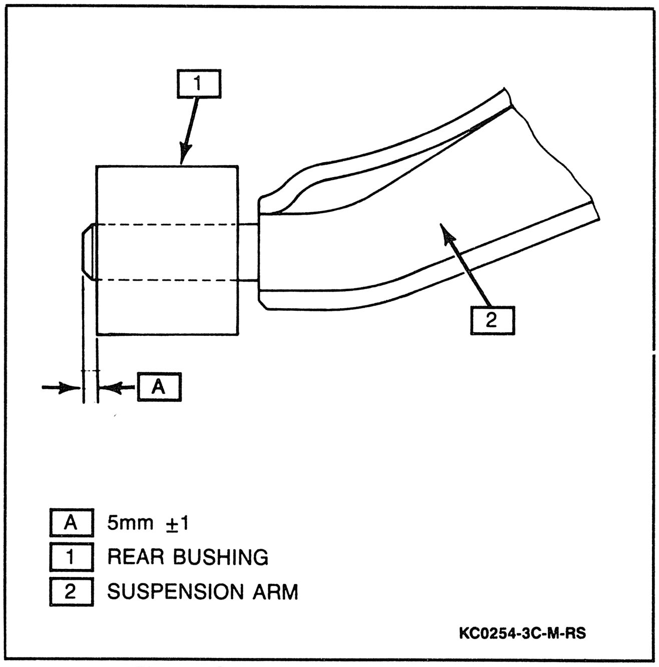

1
2
A
A 5mm ±1
1 REAR BUSHING
2 SUSPENSION ARM
KC0254-3C-M-RS

Figure 32 Rear Bushing Position

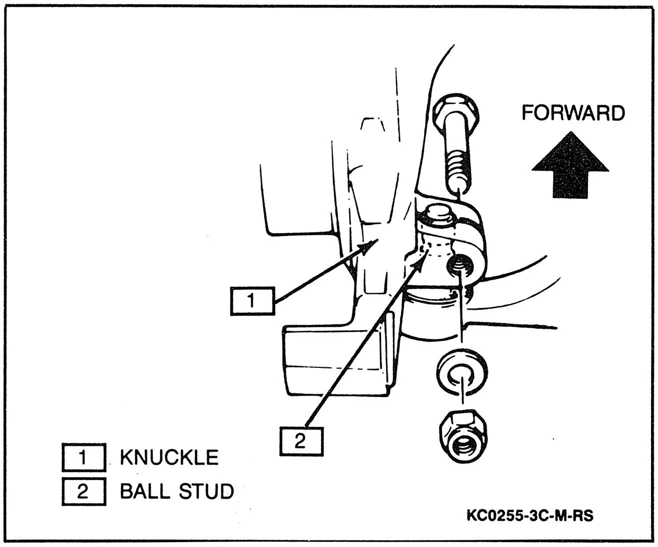

FORWARD
1
2
1 KNUCKLE
2 BALL STUD
KC0255-3C-M-RS

Figure 33 Ball Stud Installation

2. Wheel hub. Refer to "Wheel Hub Removal" in this section.
3. Tie-rod end from knuckle with special tool J21687-02 (Figure 35).
4. Strut bracket bolts from strut bracket and ball stud bolt.
5. Knuckle (Figure 39).

Install or Connect

1. Knuckle to ball stud on suspension arm and strut bracket (Figure 39). Align knuckle bolt hole with ball stud groove and ball stud bolt (Figure 37).
   - Ball stud nut to 60 N·m (44 lb.ft.).
   - Strut bracket nut to 80 N·m (59 lb.ft.).
   - Tie-rod end castle nut to 43 N·m (32 lb.ft.).
2. Tie-rod end to knuckle.

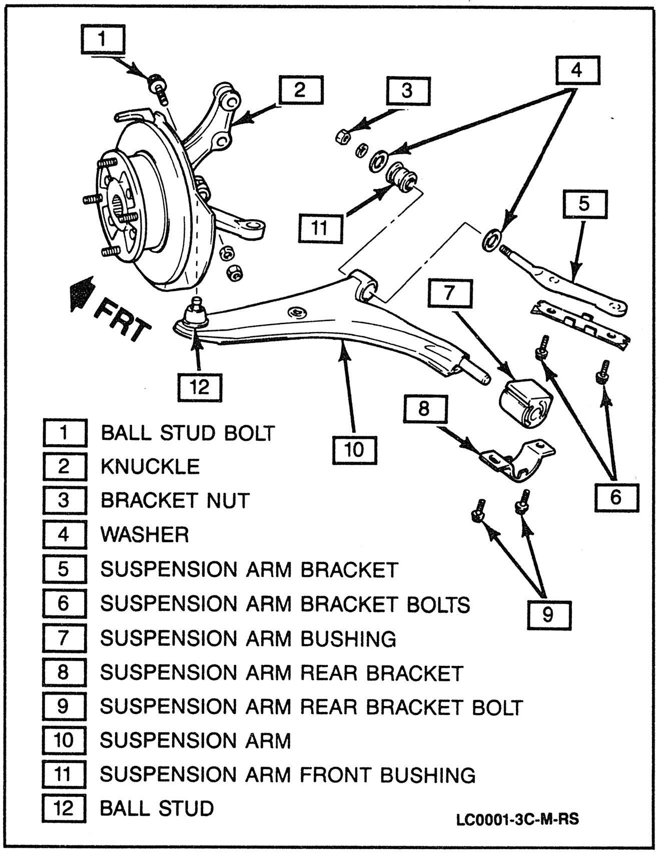

FRT
1 BALL STUD BOLT
2 KNUCKLE
3 BRACKET NUT
4 WASHER
5 SUSPENSION ARM BRACKET
6 SUSPENSION ARM BRACKET BOLTS
7 SUSPENSION ARM BUSHING
8 SUSPENSION ARM REAR BRACKET
9 SUSPENSION ARM REAR BRACKET BOLT
10 SUSPENSION ARM
11 SUSPENSION ARM FRONT BUSHING
12 BALL STUD
LC0001-3C-M-RS

Figure 34 Front Suspension

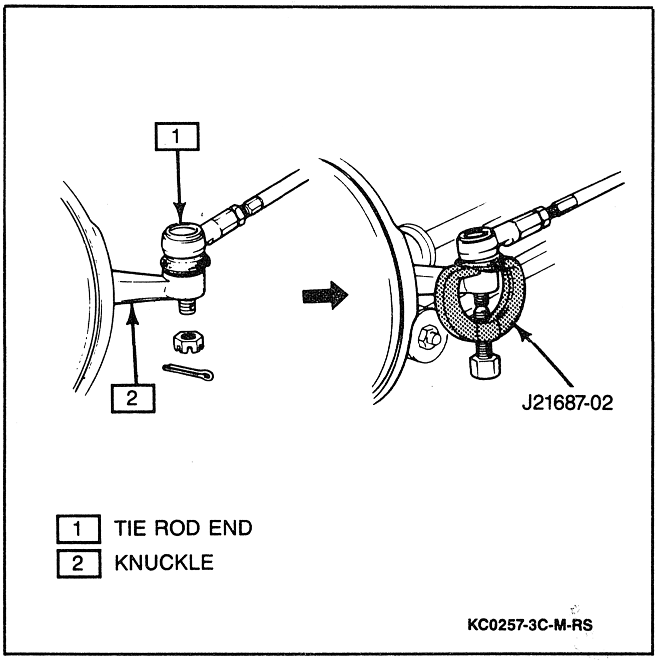

1
2
J21687-02
1 TIE ROD END
2 KNUCKLE
KC0257-3C-M-RS

Figure 35 Tie-Rod End Removal

Tighten

Tie-rod end castle nut.

3. Split pin (Figure 38).
4. Wheel hub and wheel. Refer to "Wheel Hub Installation" in this section.
5. Lower vehicle.

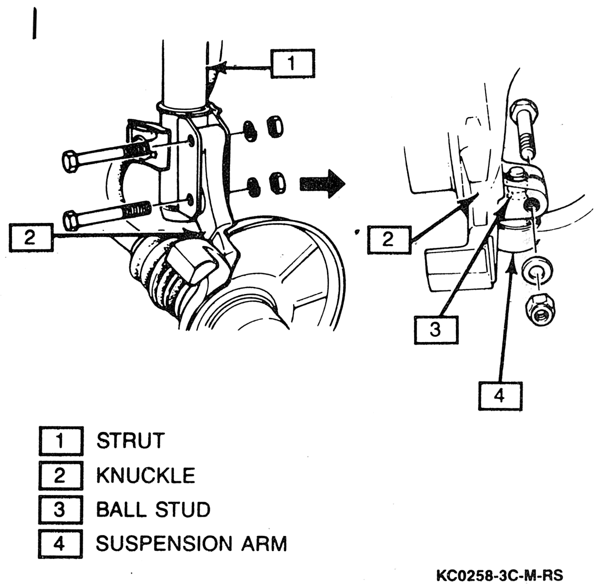

1
2
2
3
4
1 STRUT
2 KNUCKLE
3 BALL STUD
4 SUSPENSION ARM
KC0258-3C-M-RS

Figure 36 Strut Bracket Bolt Removal

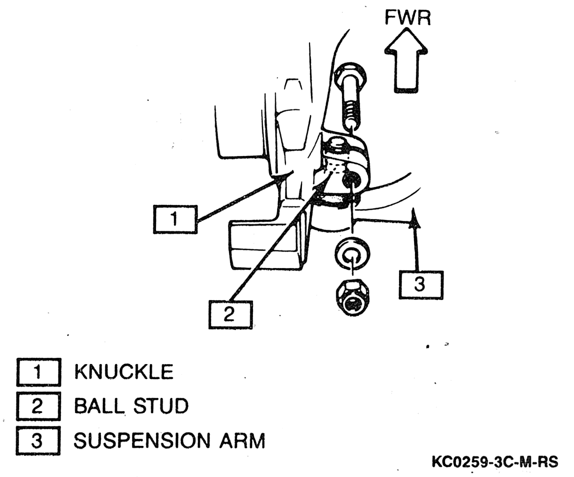

FWR
1
2
3
1 KNUCKLE
2 BALL STUD
3 SUSPENSION ARM
KC0259-3C-M-RS

Figure 37 Knuckle to Ball Stud Installation

WHEEL BEARING

Figures 40 through 44

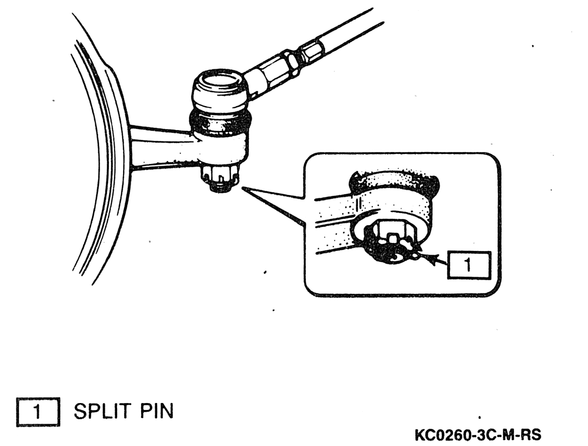

1
1 SPLIT PIN
KC0260-3C-M-RS

Figure 38 Split Pin Installation

Remove or Disconnect

1. Knuckle. Refer to "Knuckle Removal" in this section.
2. Outer and inner wheel bearings using a brass drift punch and hammer (Figures 40 and 41).

Install or Connect

NOTICE: Before installing wheel bearings, apply Wheel Bearing Lubricant #1051344 to balls and oil seal lips of wheel bearings. Also fill the clearance outside spacer "A" up to 40% clearance capacity (Figure 42).

1. Inner bearing using J34856 (Figure 43).
2. Spacer and outer bearing using J34856 (Figure 43).

NOTICE: Install outer bearing with its sealed side facing out. Spacer must be snug and centered between inner and outer bearings.

3. Oil seal until its end contacts bearing by tapping lightly around it (Figure 44).

NOTICE: When driving in oil seal, be careful not to deform or tilt it or not to cause damage to rubber part.

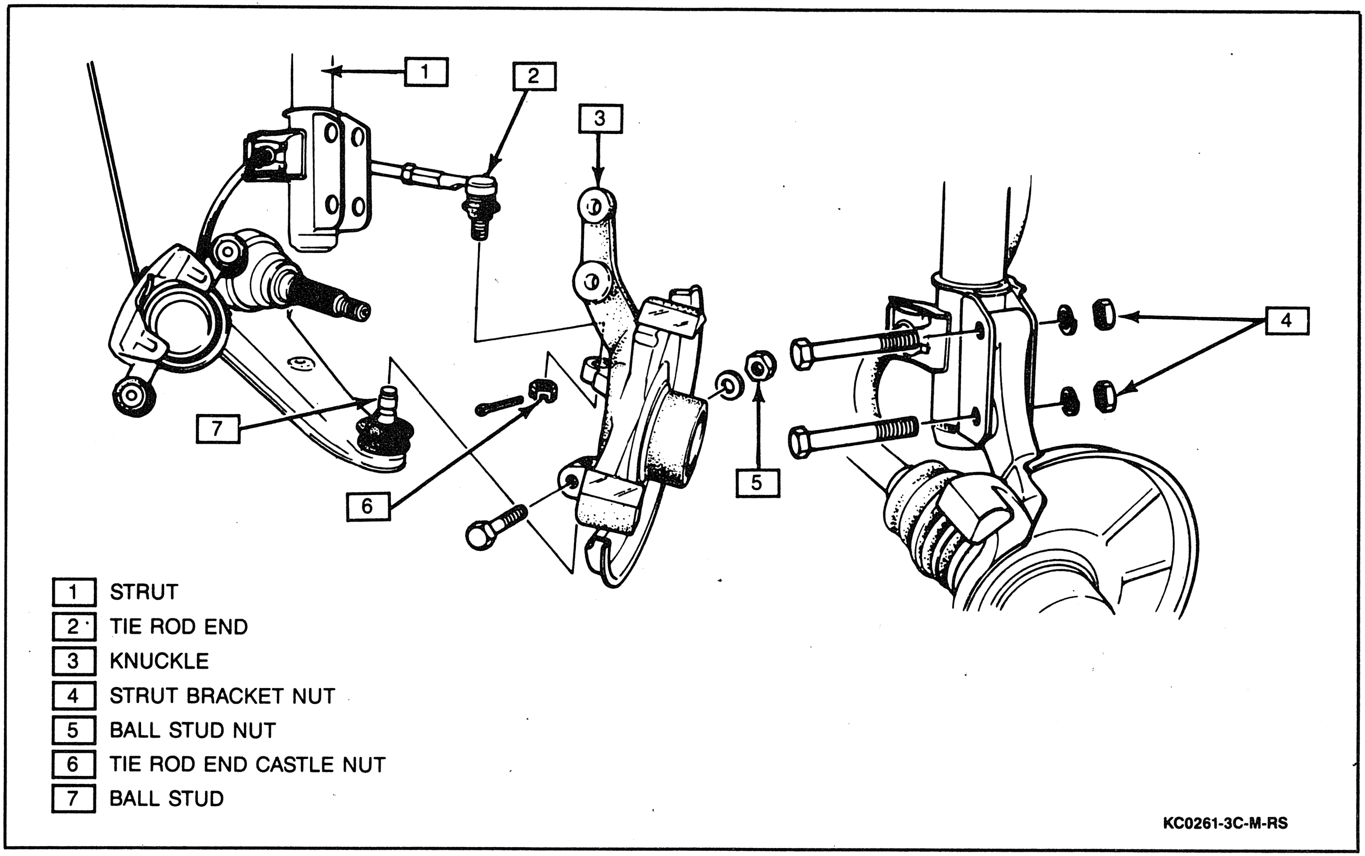

1
2
3
4
5
6
7
1 STRUT
2 TIE ROD END
3 KNUCKLE
4 STRUT BRACKET NUT
5 BALL STUD NUT
6 TIE ROD END CASTLE NUT
7 BALL STUD
KC0261-3C-M-RS

Figure 39 Front Suspension Assembly

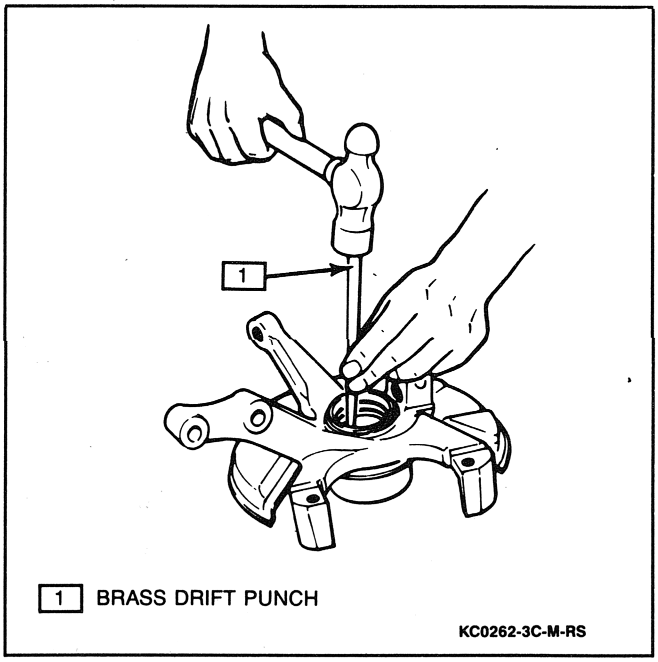

1
1 BRASS DRIFT PUNCH
KC0262-3C-M-RS

Figure 40 Wheel Outer Bearing Removal

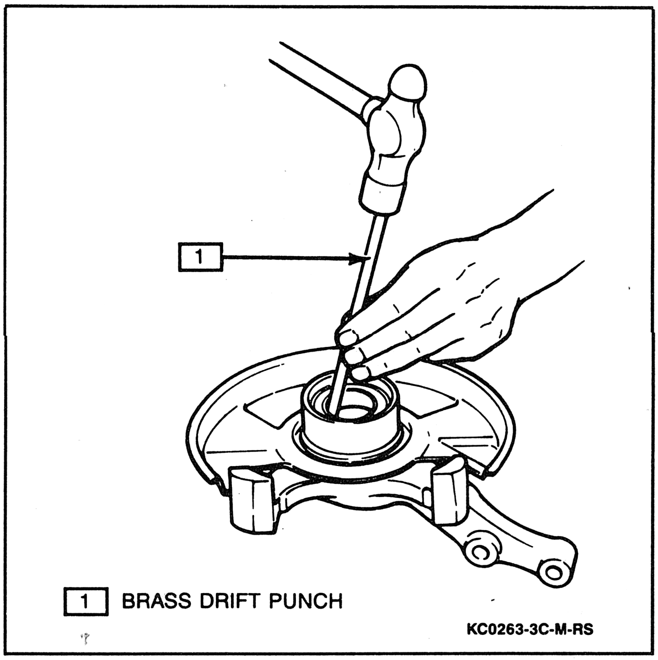

1
1 BRASS DRIFT PUNCH
KC0263-3C-M-RS

Figure 41 Wheel Inner Bearing Removal

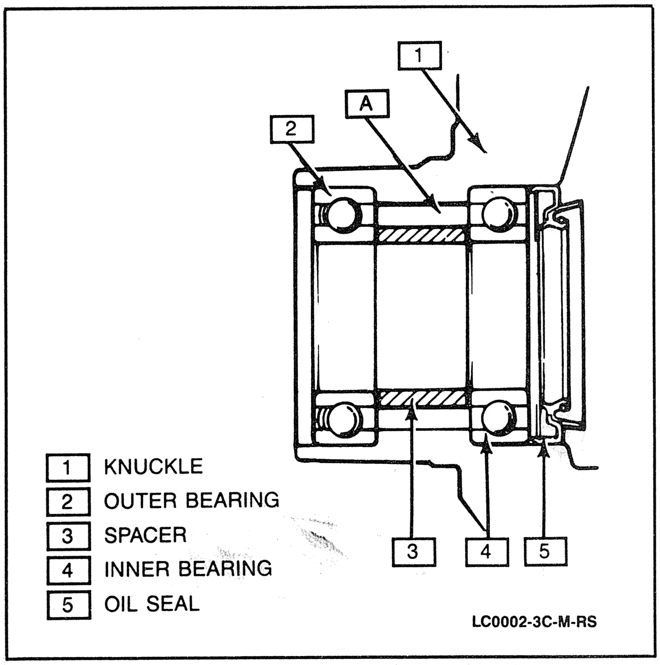

1
A
2
3
4
5
1 KNUCKLE
2 OUTER BEARING
3 SPACER
4 INNER BEARING
5 OIL SEAL
LC0002-3C-M-RS

Figure 42 Wheel Bearing Cross Section

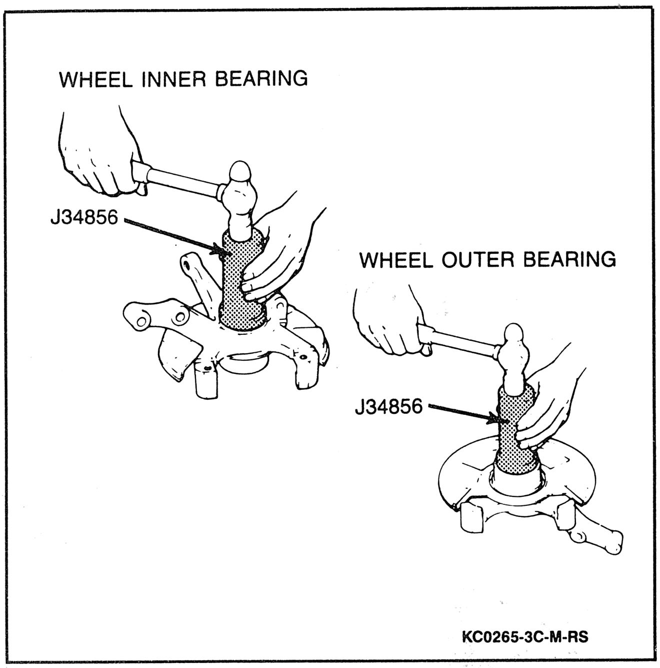

WHEEL INNER BEARING
J34856
WHEEL OUTER BEARING
J34856
KC0265-3C-M-RS

Figure 43 Wheel Bearing Installation

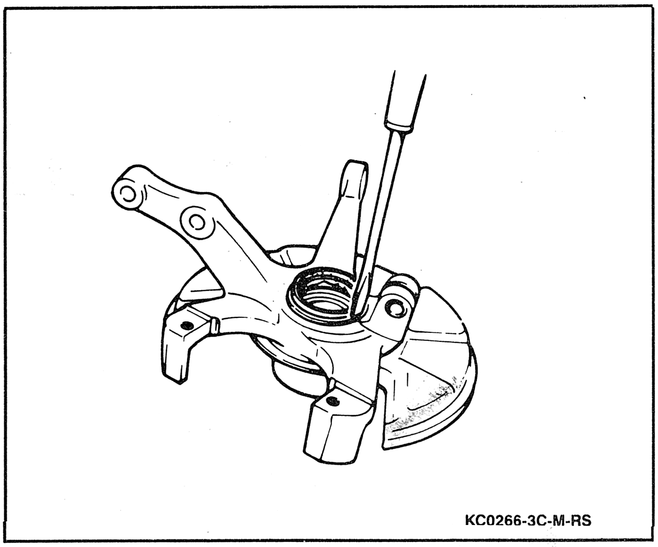

KC0266-3C-M-RS

Figure 44 Oil Seal Installation

INSPECTION

RUT DAMPER

Figure 45

Inspect

1. Strut for oil leakage. If strut is found faulty, replace it as an assembly unit because it cannot be disassembled (Figure 45).
2. Strut function check.

- Check and adjust tire pressures as specified. Bounce car body three or four times continuously by pushing front end on the side with strut to be checked. Apply the same amount of force at each push and note strut resistance both when pushed and rebounding. Also, note how many times car body rebounds before coming to stop after hands are off. Do the same for strut on the other side. Compare strut resistance and number of rebounds on the right with those on the left. They must be equal in both. With proper strut, car body should come to a stop the moment hands are off or after only one or two small rebounds. If struts are suspected, compare them with a known good car or strut.

3. For damage or deformation.
4. Bearing for wear, abnormal noise, or gripping.
5. For cracks or deformation in spring seat.
6. For deterioration of bump stopper.
7. Rebound stopper and strut mount for wear, cracks, or deformation.

Replace any parts found defective.

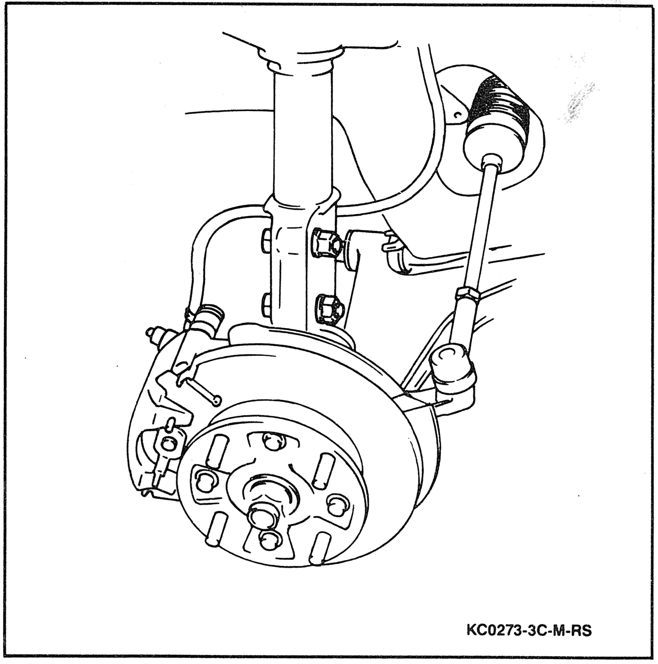

KC0273-3C-M-RS

Figure 45 Strut Damper Assembly

SUSPENSION ARM/ARM BRACKET/KNUCKLE ARM

Figure 46

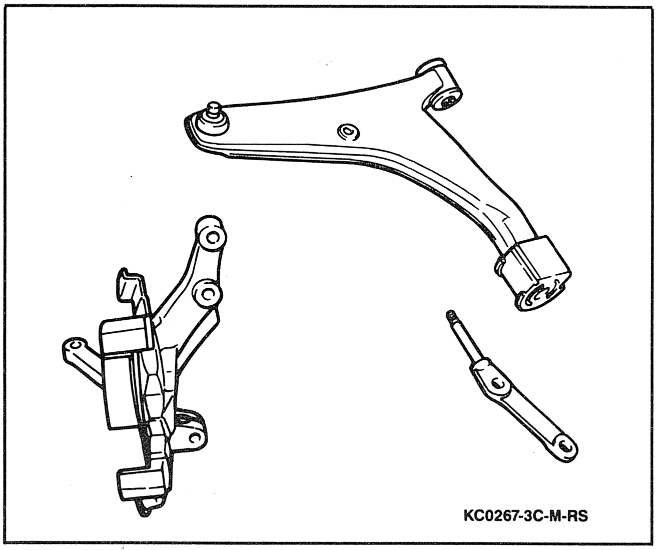

KC0267-3C-M-RS

Figure 46 Suspension Arm/Arm Bracket/Knuckle Arm Components

Inspect

1. Inspect for cracks, deformation, or damage.

SUSPENSION ARM JOINT

Figure 47

Inspect

1. For smooth rotation
2. Ball stud for damage.
3. Dust cover for damage.

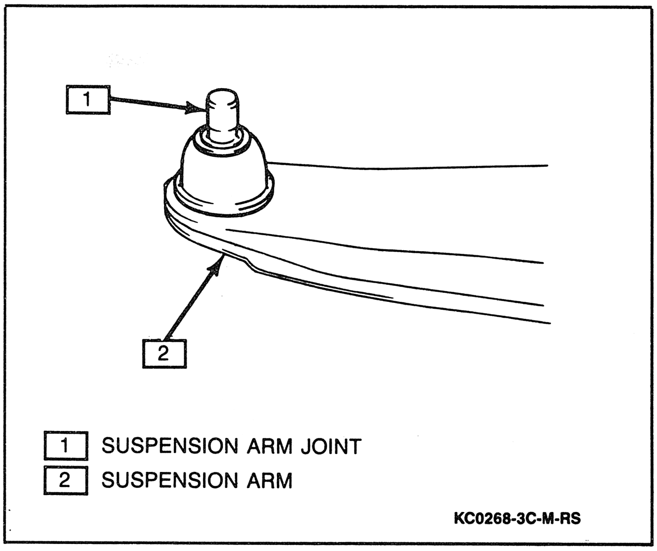

1
2
1 SUSPENSION ARM JOINT
2 SUSPENSION ARM
KC0268-3C-M-RS

Figure 47 Arm Joint

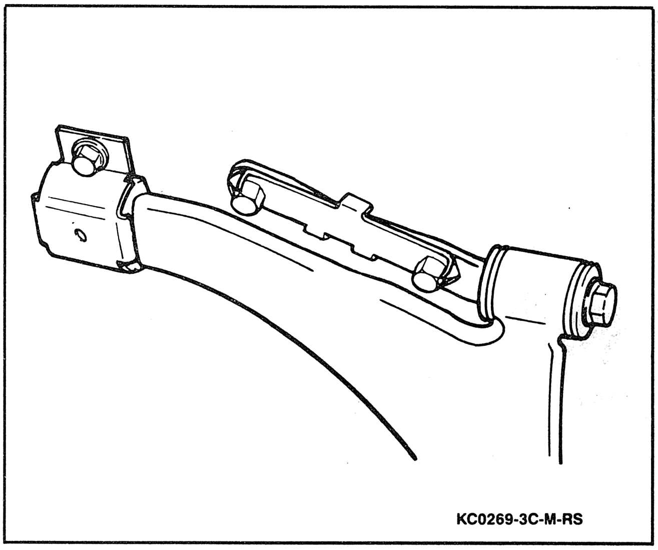

KC0269-3C-M-RS

Figure 48 Bushing Inspection

NOTICE: Suspension arm and arm joint cannot be separated.

If there is any damage to either suspension arm or joint, suspension arm assembly must be replaced as a complete unit.

SUSPENSION ARM BUSHING

Figure 48

Inspect

1. For damage, wear, or deterioration.

WHEEL DISC, NUT AND BEARING

Figure 49

Inspect

1. Each wheel disc for dents, distortion, and cracks. A disc in badly damaged condition must be replaced.

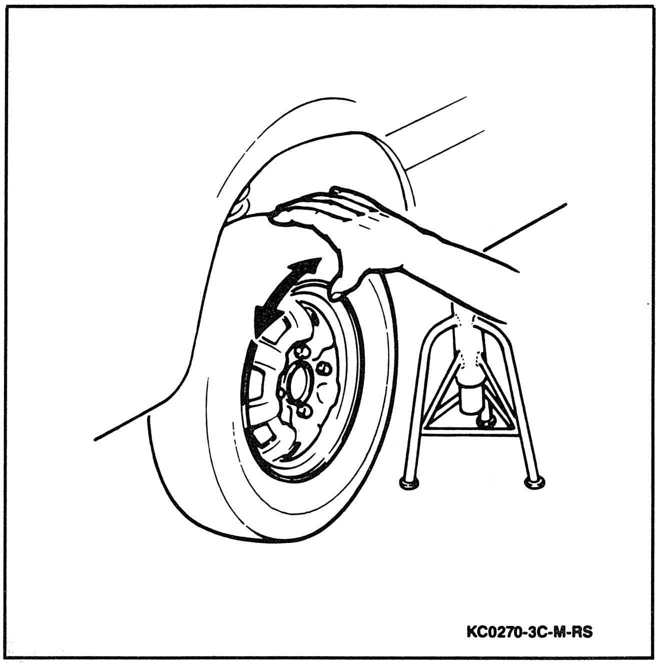


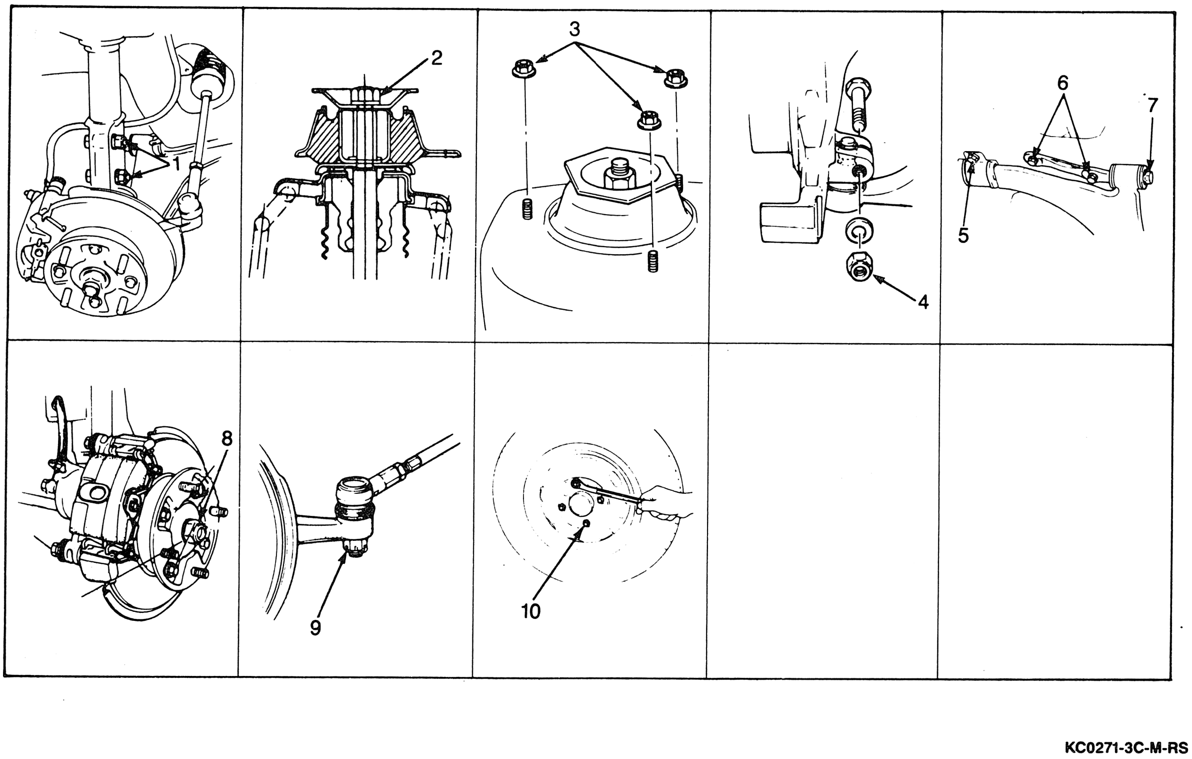
Figure 49 Bearing Inspection

2. Wheel nuts for proper torque.
3. Wheel bearing for wear. When measuring thrust play, apply a dial gage to wheel hub center after removing wheel center cap from wheel disc.
   - Thrust play limit is 0.4 mm (0.016 in.).

   When measurement exceeds limit, replace bearing.
4. Wheel bearing for noise and smooth rotation by rotating wheel. If defective, replace bearing.

TORQUE SPECIFICATIONS

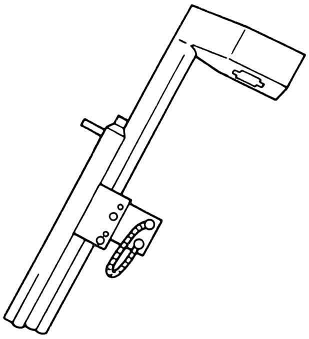
1.	Strut bracket nut	80 N·m (59 lb.ft.)
2.	Strut nut	50 N·m (37 lb.ft.)
3.	Strut support nut	27 N·m (20 lb.ft.)
4.	Ball stud nut	60 N·m (44 lb.ft.)
5.	Suspension arm rear bracket bolt	43 N·m (32 lb.ft.)
6.	Suspension arm bracket bolt	93 N·m (69 lb.ft.)
7.	Bracket nut	125 N·m (92 lb. ft.)
8.	Drive axle nut	175 N·m (129 lb.ft.)
9.	Tie-rod end castle nut	43 N·m (32 lb.ft.)
10.	Wheel nut	60 N·m (44 lb.ft.)


1
2
3
4
5
6
7
8
9
10
KC0271-3C-M-RS

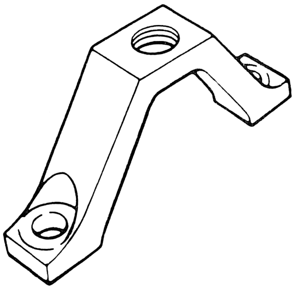
SERVICE MATERIALS

Materials	Use
GM Wheel Bearing Lubricant #1051344	Wheel bearing, wheel bearing oil seal lip.

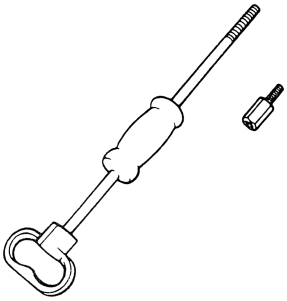
SPECIAL TOOLS



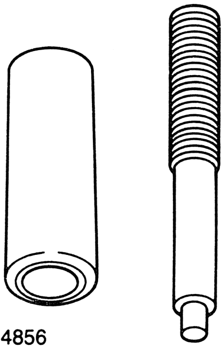
J34013-A
Spring compressor



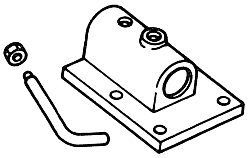
J34866
Front wheel hub remover



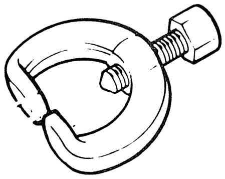
J2619-01
Sliding hammer



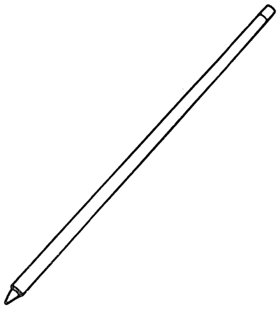
J34856
J7079-2
Bearing & hub installer



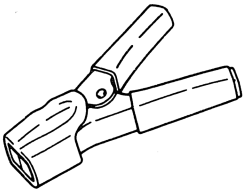
J3289-20
Holding fixture
bench mount



J21687-02
Tie rod end remover



J34013-38
Alignment rod



J34013-20
Damper rod clamp

KC0272-3C-M-RS

SECTION 3D

REAR SUSPENSION

NOTICE: When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part fastener is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are not reused, and those requiring thread locking compound will be called out. The correct torque value must be used when installing fasteners that require it. If the above conditions are not followed, parts or system damage could result. Never attempt to heat, quench or straighten any suspension part. Replace it with a new part, or damage to the part may result.

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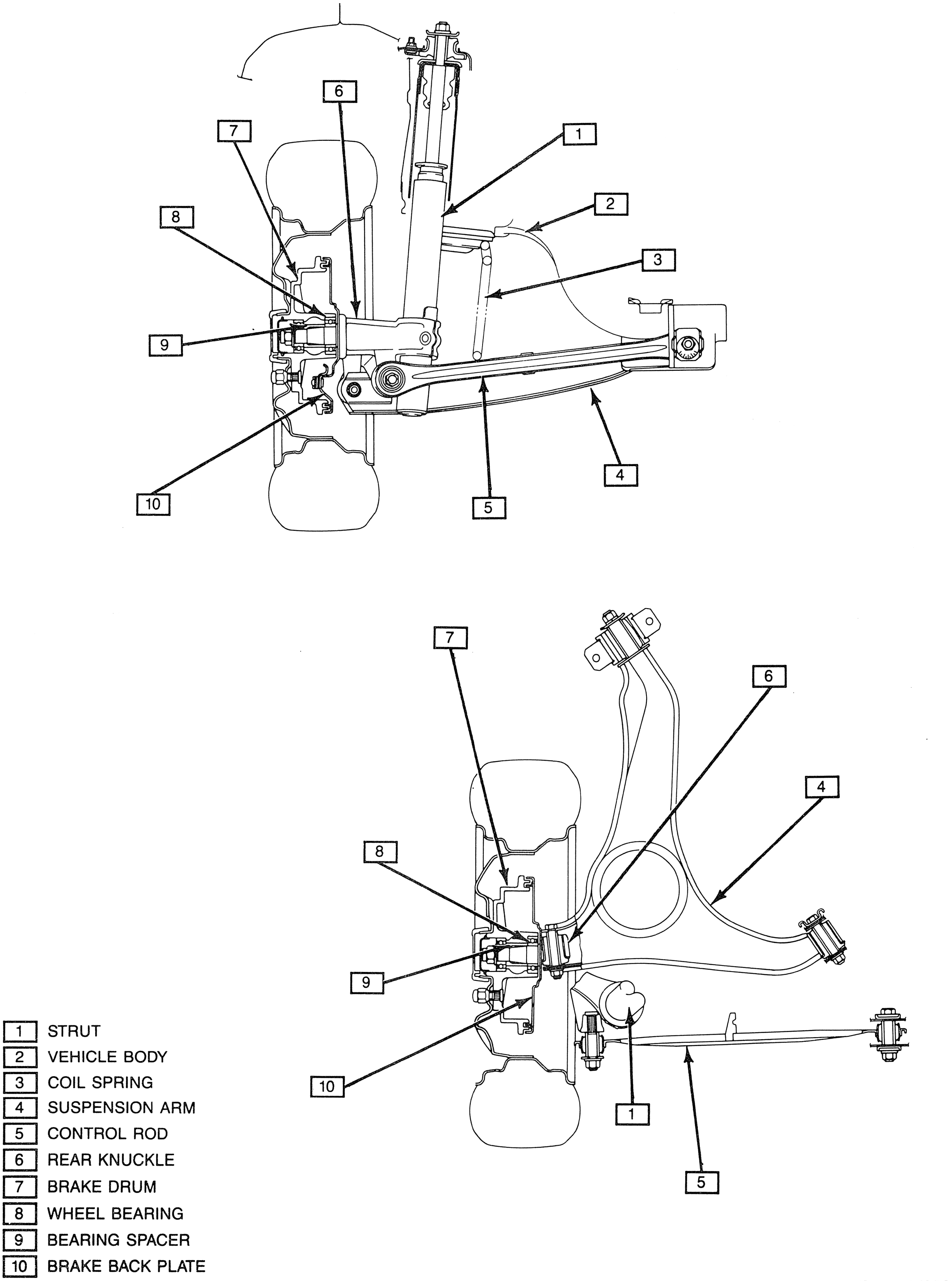
GENERAL DESCRIPTION

The upper end of the strut is installed to the car body with a rubber mount in between and its lower side to the rear knuckle, whose lower end is connected to the suspension arm through the rubber bushing. There is a coil spring between the suspension arm and car body (Figure 1).


6
7
1
8
2
3
9
10
5
4
7
6
4
8
9
10
1
5
KC0279-3D-M-RS

1	STRUT
2	VEHICLE BODY
3	COIL SPRING
4	SUSPENSION ARM
5	CONTROL ROD
6	REAR KNUCKLE
7	BRAKE DRUM
8	WHEEL BEARING
9	BEARING SPACER
10	BRAKE BACK PLATE

Figure 1 Rear Suspension Cross Section

ON-VEHICLE SERVICE

RIDE COMPLAINTS

If complaints of hard ride are encountered, the first items to investigate are tire pressure, trim height and strut condition. If these are correct, the amount of friction in the rear suspension should be checked. For additional diagnosis on this system, refer to STEERING, SUSPENSION, WHEELS AND TIRES DIAGNOSIS (Section 3).

EXCESSIVE FRICTION CHECK

The procedure for checking excessive friction in the rear suspension is as follows:

1. With aid of helper, lift up on the rear bumper and raise car as high as possible. Slowly release the bumper and allow the car to resume normal trim height.
2. Measure distance from floor to center of bumper.
3. Push down on bumper, release slowly and allow car to resume normal trim height.
4. Measure distance from floor to center of bumper.

The difference between the two measurements should be less than 12.7 mm (1/2 inch). If the difference exceeds this limit, inspect the control arms, struts and ball joints for damage or wear.

CONTROL ROD

Figures 1 through 7

↔ Remove or Disconnect

1. Hoist vehicle and remove wheel.
2. Brake flexible hose from control rod by pulling E-ring off with pliers (Figure 2).

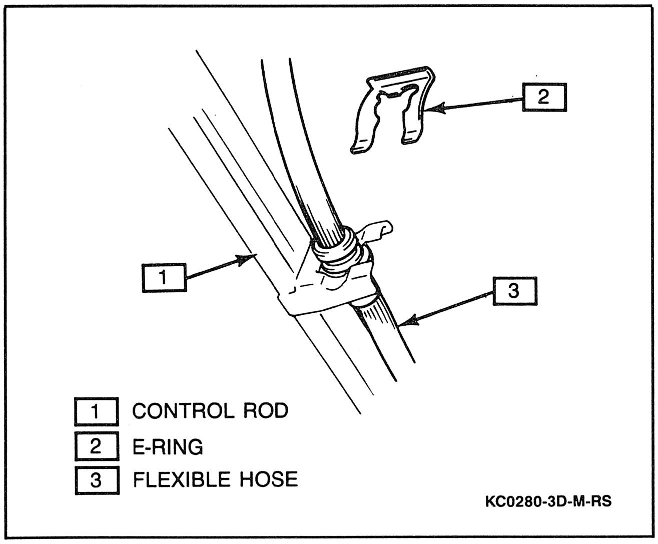


Figure 2 Brake Flexible Hose Removal

NOTICE: To facilitate toe adjustment after reinstallation, take following preparatory step before removing control rod. Confirm which one of lines stamped line "A" on car body or make match marks.

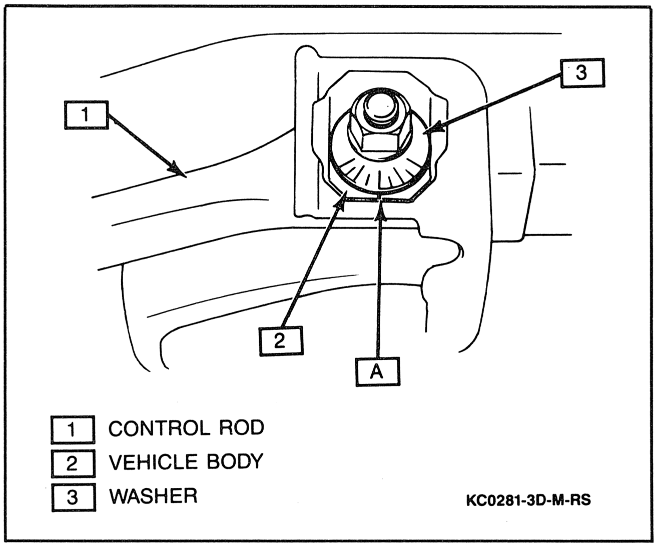


Figure 3 Control Rod Markings

3. Control rod outside nut (Figure 4).
4. Loosen control rod inside nut (body center side) (Figure 4).

NOTICE: Hold inside bolt with another wrench to prevent it from turning as nut is turned.

1. Control rod inside bolt and control rod.

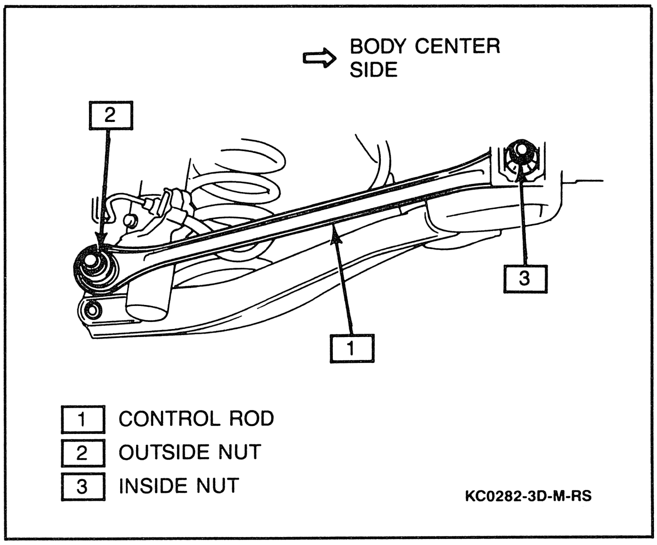


Figure 4 Control Rod Removal

→← Install or Connect

NOTICE: To determine installing direction of control rod note angle of the brake flexible hose mounting brackets welded to control rod (Figure 5).

1. Control rod inside bolt with its cam "B" faced down (Figure 6).
2. Control rod nuts (inside and outside), but do not torque to specification.

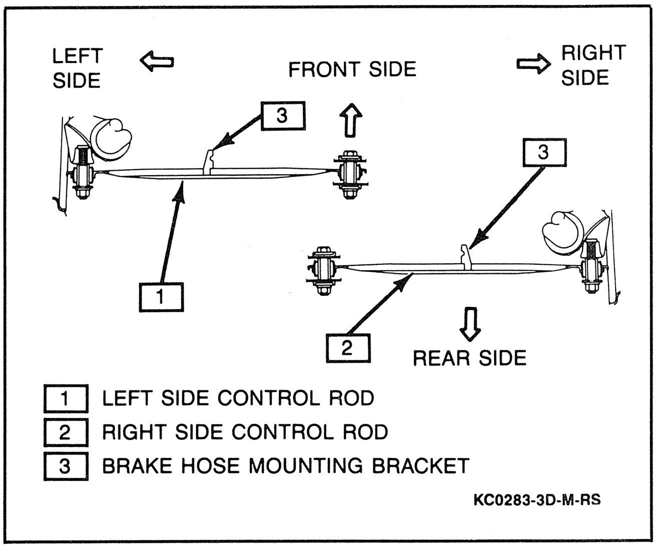

LEFT SIDE
FRONT SIDE
RIGHT SIDE
3
3
1
2
REAR SIDE
1 LEFT SIDE CONTROL ROD
2 RIGHT SIDE CONTROL ROD
3 BRAKE HOSE MOUNTING BRACKET
KC0283-3D-M-RS

Figure 5 Control Rod Installation Direction

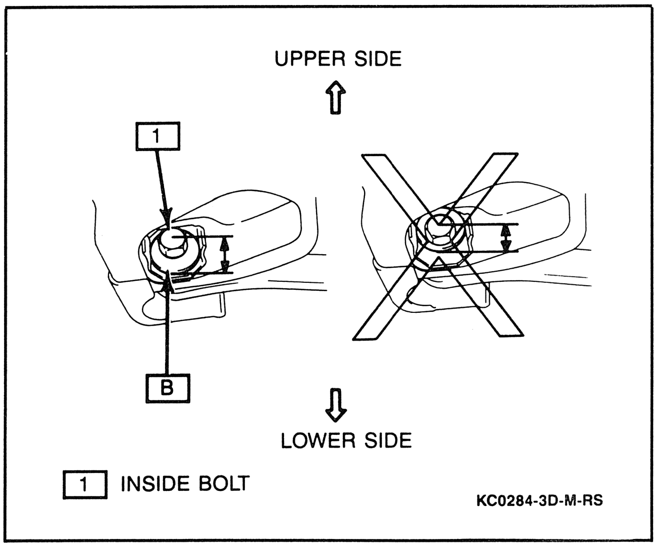

UPPER SIDE
1
B
LOWER SIDE
1 INSIDE BOLT
KC0284-3D-M-RS

Figure 6 Control Rod Cam

3. Brake flexible hose to control rod with E-rings (Figure 7).
4. Wheel.
5. Lower hoist.

Tighten

- Control rod outside nut and inside nut to 80 N·m (59 lb.ft.).
- It is most desirable to have vehicle on hoist and in non-loaded condition when tightening them.
- When tightening inside nut, align line "A" stamped on body with line on washer as confirmed during the removal procedure, or align match marks.

Inspect

- Rear toe and adjust it as necessary. For information on this procedure, refer to WHEEL ALIGNMENT (Section 3A).

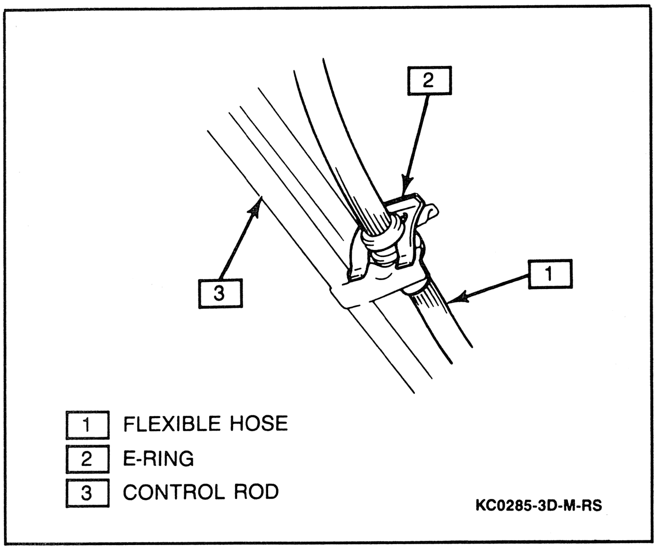

2
3
1
1 FLEXIBLE HOSE
2 E-RING
3 CONTROL ROD
KC0285-3D-M-RS

Figure 7 Brake Flexible Hose Installation

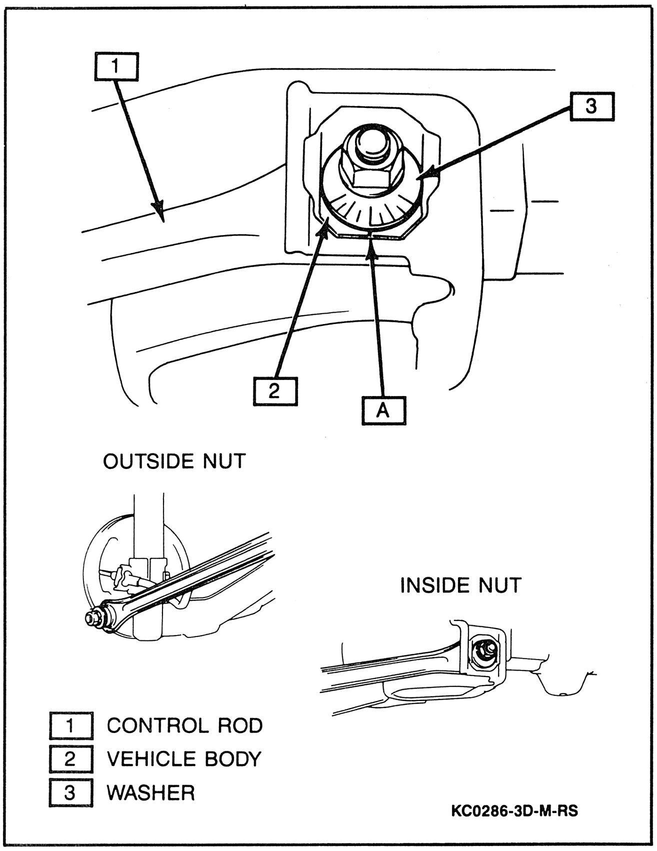

1
3
2
A
OUTSIDE NUT
INSIDE NUT
1 CONTROL ROD
2 VEHICLE BODY
3 WASHER
KC0286-3D-M-RS

Figure 8 Control Rod Outside/Inside Nuts

COIL SPRING AND SUSPENSION ARM

Figures 9 through 23

Remove or Disconnect

1. Hoist vehicle and remove wheel.

NOTICE: To facilitate toe adjustment after reinstallation, confirm which one of the lines stamped on the washer is in the closest alignment with the stamped line "A" on the control rod. If not marked, add alignment marks.

2. Control rod inside bolt (body center side) (Figure 9).

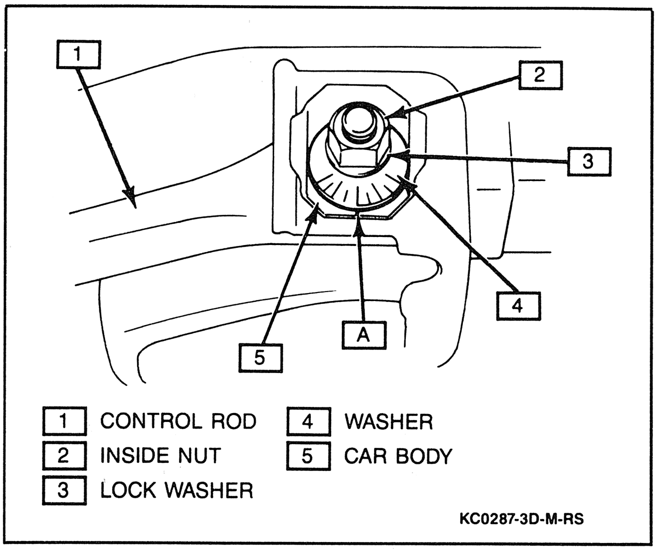

1
2
3
4
A
5
1 CONTROL ROD
2 INSIDE NUT
3 LOCK WASHER
4 WASHER
5 CAR BODY
KC0287-3D-M-RS

Figure 9 Control Rod Inside Bolt Removal

3. Outside (wheel side) of control rod from rear knuckle stud bolt (Figure 10).

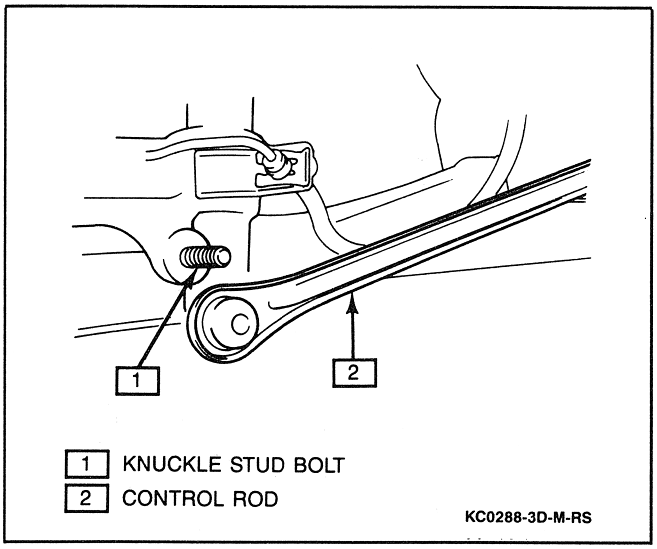

1
2
1 KNUCKLE STUD BOLT
2 CONTROL ROD
KC0288-3D-M-RS

Figure 10 Control Rod From Knuckle Removal

4. Loosen rear mount nut of suspension arm, but do not remove bolt (Figure 11).
5. Loosen front nut of suspension arm (Figure 12).
6. Loosen lower mount nut of knuckle, then place jack under suspension arm to prevent it from lowering and remove lower mount nut of knuckle.
7. Raise jack placed under suspension arm enough to allow removal of lower mount bolt of knuckle (Figure 14).
8. Move brake drum/brake back plate toward outside of car body (in arrow direction) to separate lower mount of knuckle from suspension arm. Then lower jack gradually and remove coil spring (Figure 15).
9. Suspension arm.

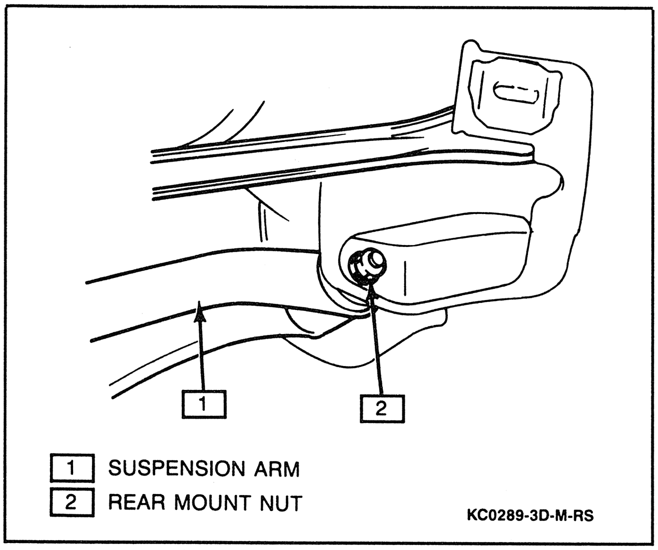

1
2
1 SUSPENSION ARM
2 REAR MOUNT NUT
KC0289-3D-M-RS

Figure 11 Rear Mount Nut

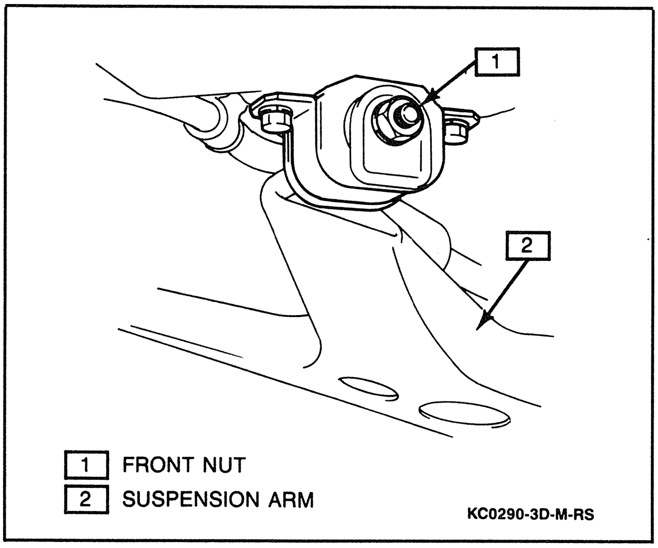

1
2
1 FRONT NUT
2 SUSPENSION ARM
KC0290-3D-M-RS

Figure 12 Front Suspension Arm Nut

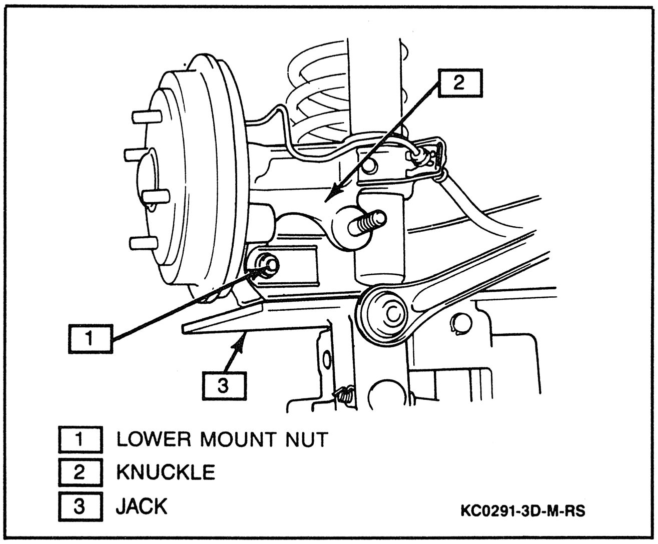

2
1
3
1 LOWER MOUNT NUT
2 KNUCKLE
3 JACK
KC0291-3D-M-RS

Figure 13 Lower Mount Nut Removal

Install or Connect

1. Front mounting bracket bolts (Figure 17).

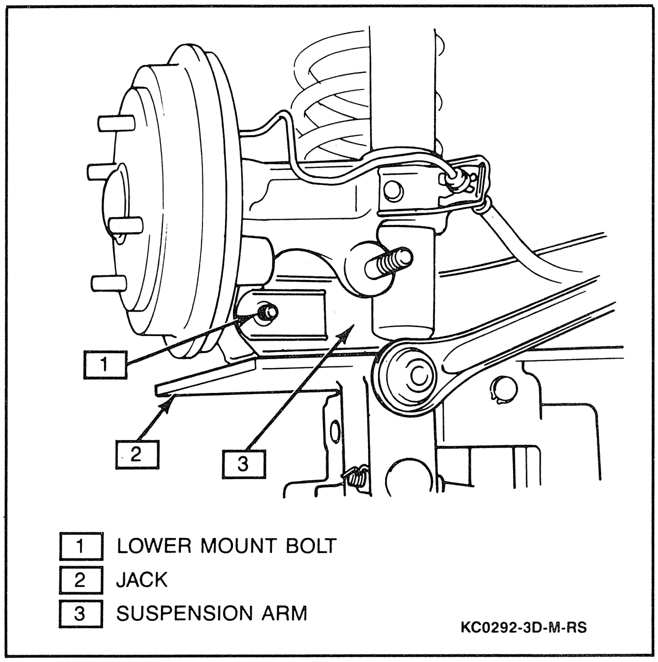

1
2
3
1 LOWER MOUNT BOLT
2 JACK
3 SUSPENSION ARM
KC0292-3D-M-RS

Figure 14 Lower Mount Bolt Removal

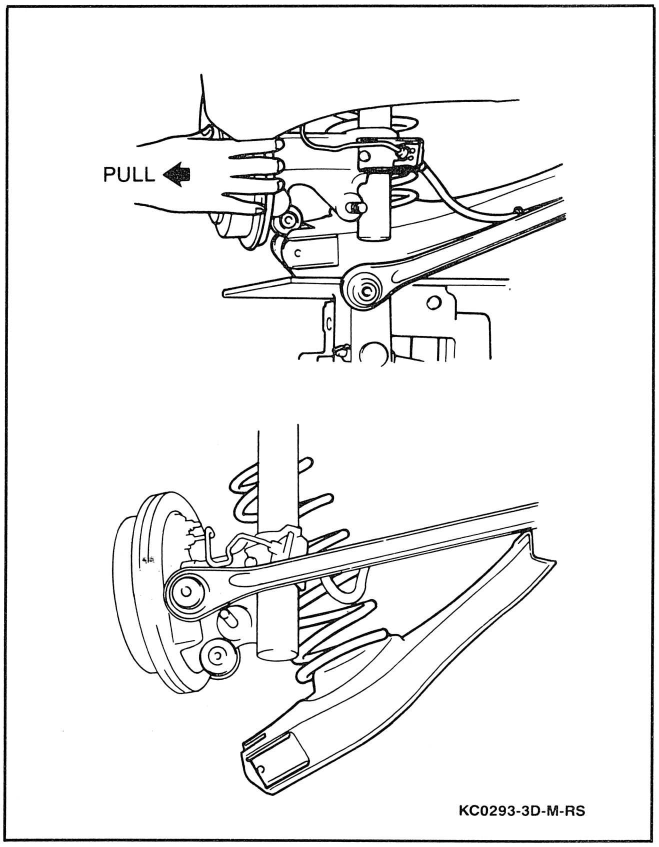

PULL
KC0293-3D-M-RS

Figure 15 Coil Spring Removal

Tighten

- Front mounting bracket bolts to 45 N·m (33 lb. ft.)

2. Rear and front mounting nuts, but do not torque to specification.

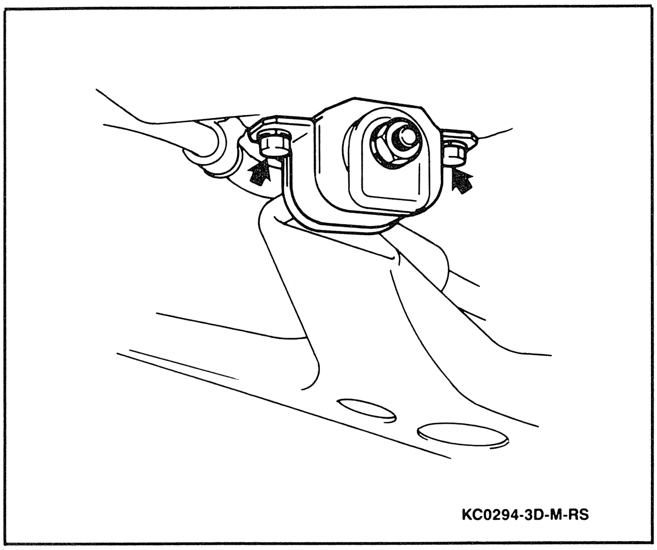

KC0294-3D-M-RS

Figure 16 Suspension Arm Front End Removal

NOTICE: Make sure that front mounting washer is installed in proper direction referring to figure below.

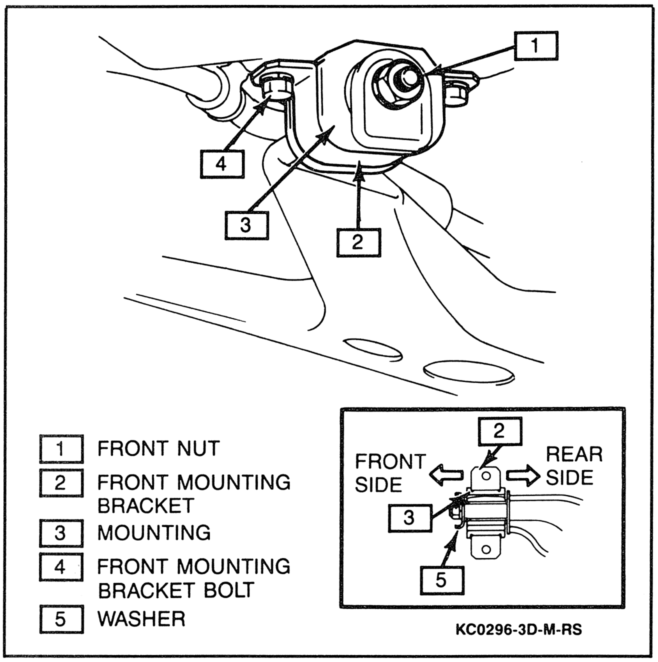

1
4
3
2
1 FRONT NUT
2 FRONT MOUNTING BRACKET
3 MOUNTING
4 FRONT MOUNTING BRACKET BOLT
5 WASHER
2
FRONT SIDE
REAR SIDE
3
5
KC0296-3D-M-RS

Figure 17 Front Mounting Bracket

3. Jack under suspension arm.
4. Coil spring on spring seat of suspension arm and then raise suspension arm (Figure 18).

NOTICE: When seating coil spring, mate spring end with stepped part of suspension arm spring seat as shown.

5. Lower mount bolt of knuckle (Figure 19).

Tighten

- Lower mount bolt of knuckle to 50 N·m (37 lb. ft.).

6. Remove jack from under suspension arm.

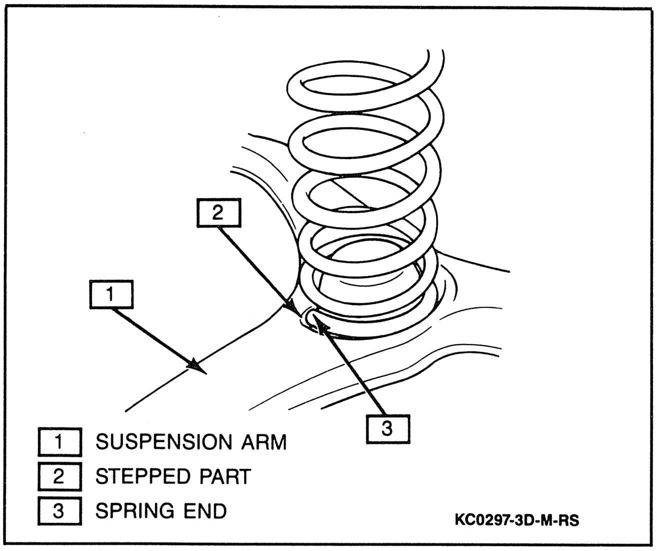

1
2
3
1 SUSPENSION ARM
2 STEPPED PART
3 SPRING END
KC0297-3D-M-RS

Figure 18 Coil Spring Seat

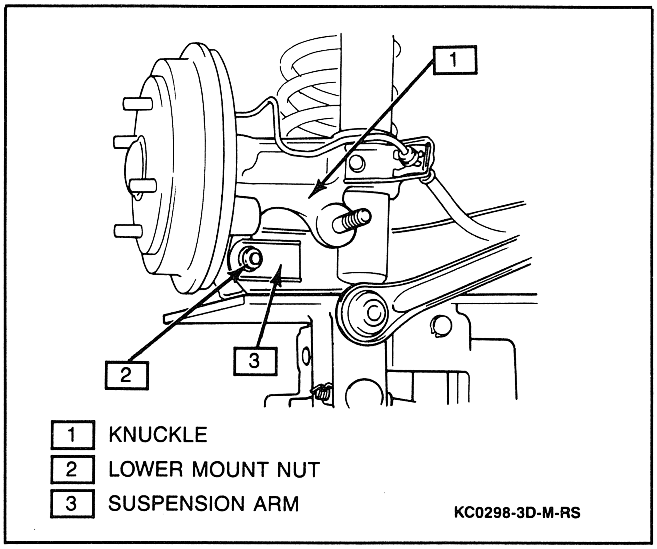

1
2
3
1 KNUCKLE
2 LOWER MOUNT NUT
3 SUSPENSION ARM
KC0298-3D-M-RS

Figure 19 Lower Mount Bolt Installation

7. Inside and outside control rod bolts, but do not torque.

NOTICE: When installing inside bolt, refer to Control Rod Installation in this section.

8. Wheel.
9. Lower hoist.
10. Control rod outside nut and inside nut (Figure 20).

Tighten

- Control rod outside and inside nut to 80 N·m (59 lb. ft.).

NOTICE: When tightening nuts, it is most desirable to have the car off the hoist and in a non-loaded state. Also, when tightening inside nut, align line "A" stamped on body with line on washer as confirmed before removal or align match marks if marked (Figure 21).

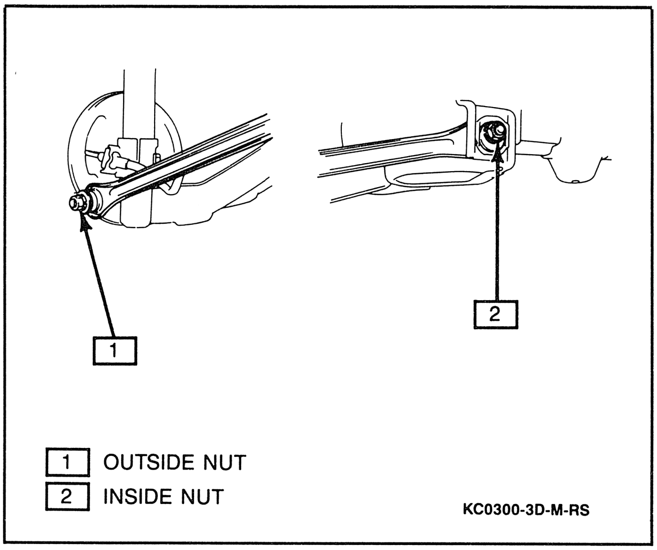

1
2
1 OUTSIDE NUT
2 INSIDE NUT
KC0300-3D-M-RS

Figure 20 Control Rod Inside/Outside Nut

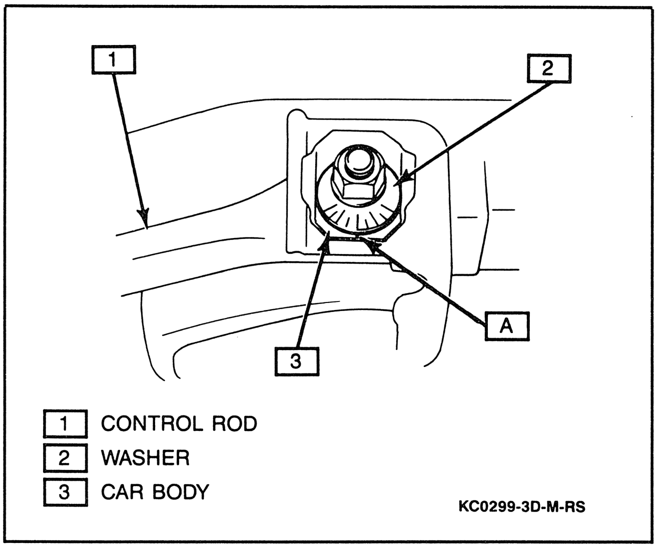

1
2
A
3
1 CONTROL ROD
2 WASHER
3 CAR BODY
KC0299-3D-M-RS

Figure 21 Control Rod Nut Alignment

11. Suspension arm front and rear nuts (Figure 22).

Tighten

- Suspension arm front/rear nuts to 60 N·m (44 lb. ft.) and 5 N·m (37 lb. ft) respectively.

NOTICE: After tightening suspension arm outer nut, make sure that washer is not tilted (Figure 23).

Inspect

- Rear toe and adjust it as necessary. For information on this procedure, refer to WHEEL ALIGNMENT (Section 3A).

REAR STRUT ASSEMBLY

Figures 24 through 31

Remove or Disconnect

1. Hoist vehicle and remove wheel.

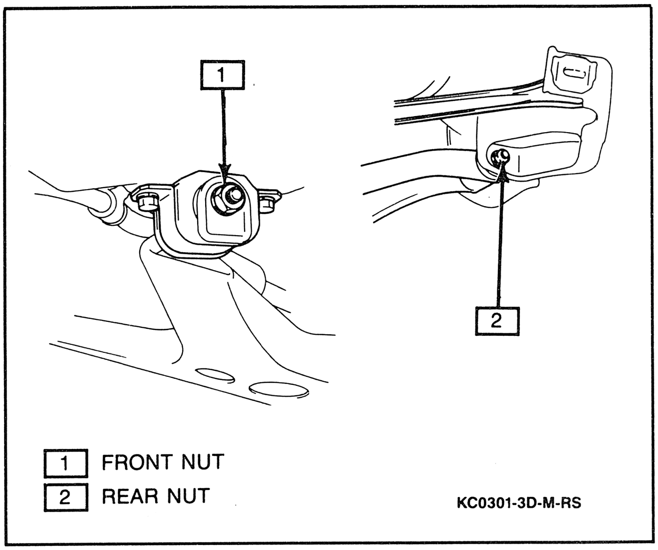

1
2
1 FRONT NUT
2 REAR NUT
KC0301-3D-M-RS

Figure 22 Suspension Arm Front and Rear Nuts

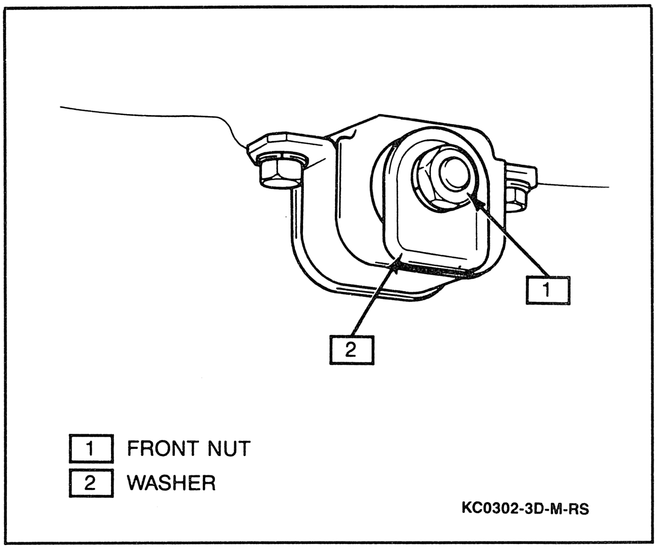

1
2
1 FRONT NUT
2 WASHER
KC0302-3D-M-RS

Figure 23 Suspenson Arm Front Nut

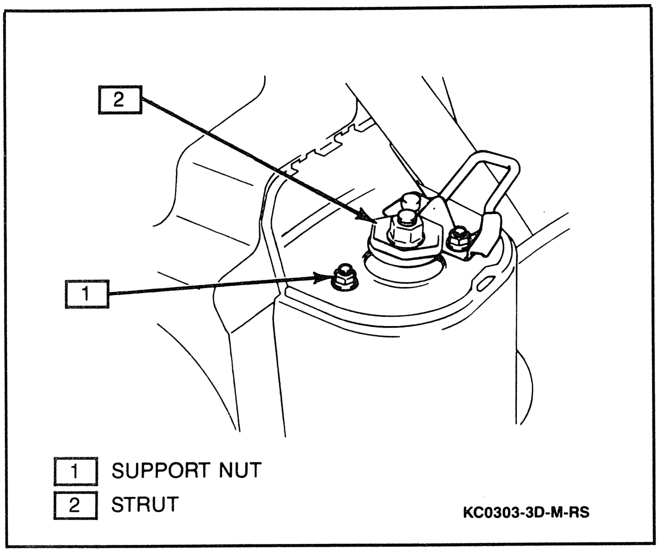

2
1
1 SUPPORT NUT
2 STRUT
KC0303-3D-M-RS

Figure 24 Strut Support Nut Removal

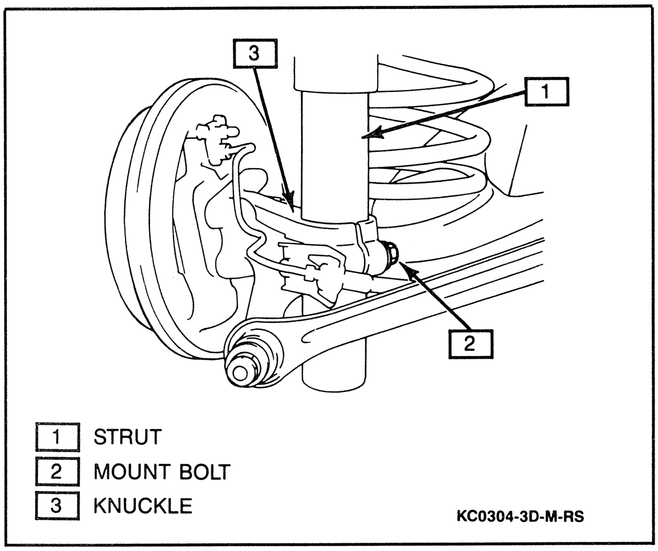

3
1
2
1 STRUT
2 MOUNT BOLT
3 KNUCKLE
KC0304-3D-M-RS

Figure 25 Strut Lower Mount Bolt Removal

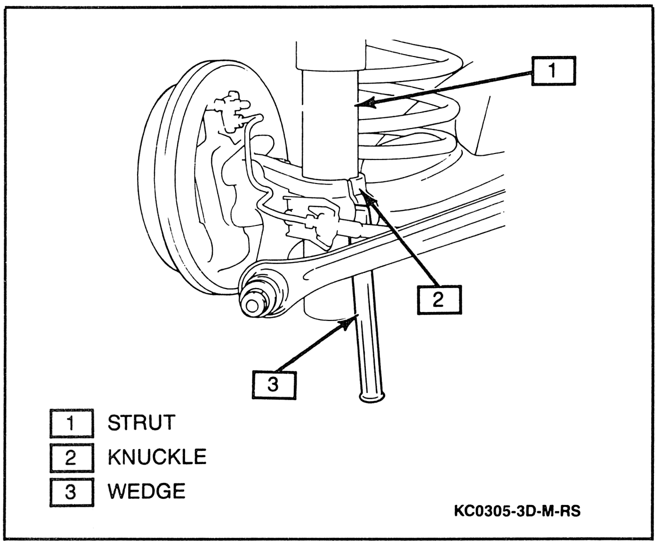

1
2
3
1 STRUT
2 KNUCKLE
3 WEDGE
KC0305-3D-M-RS

Figure 26 Strut From Knuckle Removal

2. Place jack under suspension arm for support when it lowers.
3. Strut support nuts and push strut down in direction of arrow (Figure 24).
4. Strut lower mount bolt (Figure 25).
5. Strut from knuckle by pulling upper side of knuckle. Compress strut as short as possible for removal. If strut is hard to remove, open slit of knuckle by inserting a wedge (Figure 26).

CAUTION: Do not open knuckle slit wider than necessary. Do not lower jack more than necessary during strut removal to prevent coil spring from coming off, or brake flexible hose from stretching.

→← Install or Connect

1. Compress strut by pushing in both ends (Figure 28).
2. Strut to knuckle. Align projection “A” on strut against slit of knuckle and push strut into knuckle until upper end of knuckle contacts “B” on strut (Figure 29).

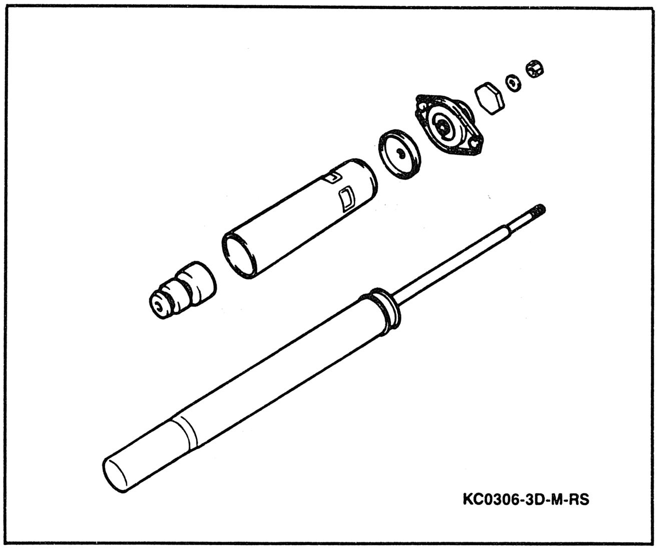

KC0306-3D-M-RS

Figure 27 Strut Assembly

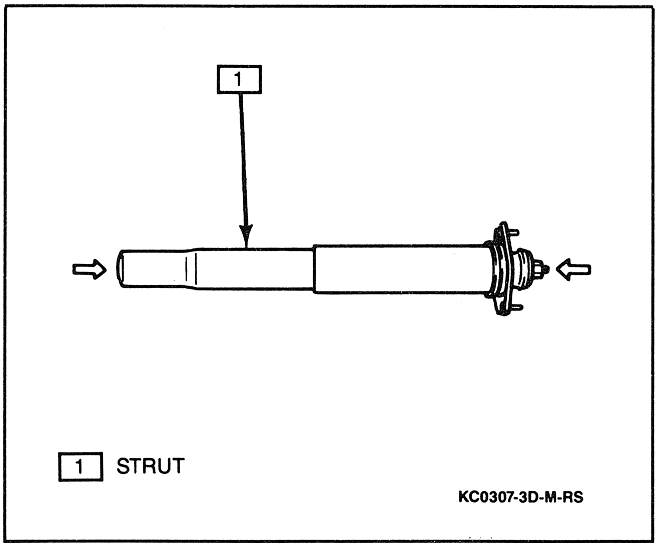

1
1 STRUT
KC0307-3D-M-RS

Figure 28 Strut Compression

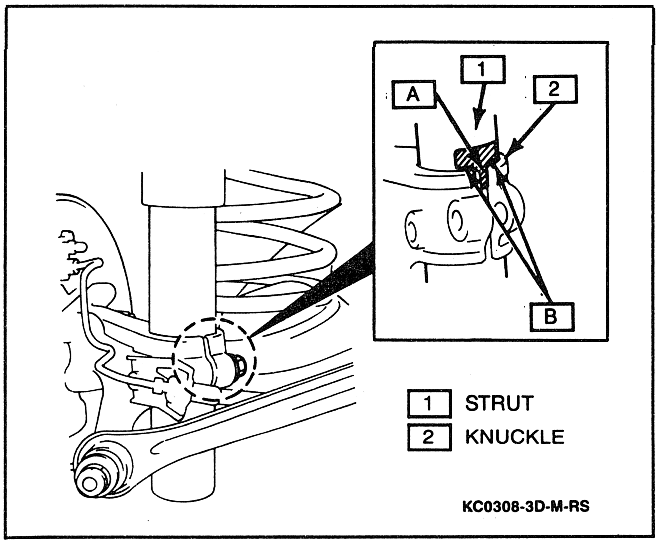

A
1
2
B
1 STRUT
2 KNUCKLE
KC0308-3D-M-RS

Figure 29 Strut to Knuckle Installation

3. Strut lower mount bolt.

Tighten

- Strut lower mount bolt to 60 N·m (44 lb. ft.).

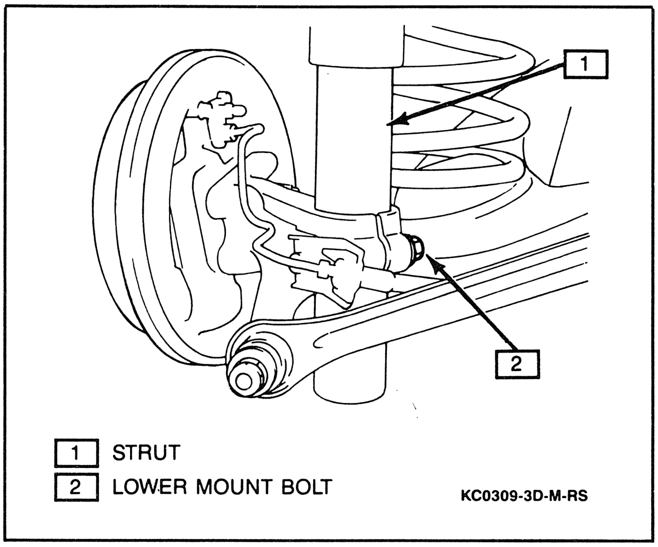

1
2
1 STRUT
2 LOWER MOUNT BOLT
KC0309-3D-M-RS

Figure 30 Lower Mount Bolt Installation

4. Upper end of strut to vehicle (Figure 31).

Tighten

- Support nuts to 30 N·m (24 ft. lb.).

NOTICE: If upper end of strut does not reach car body, raise jack under suspension arm.

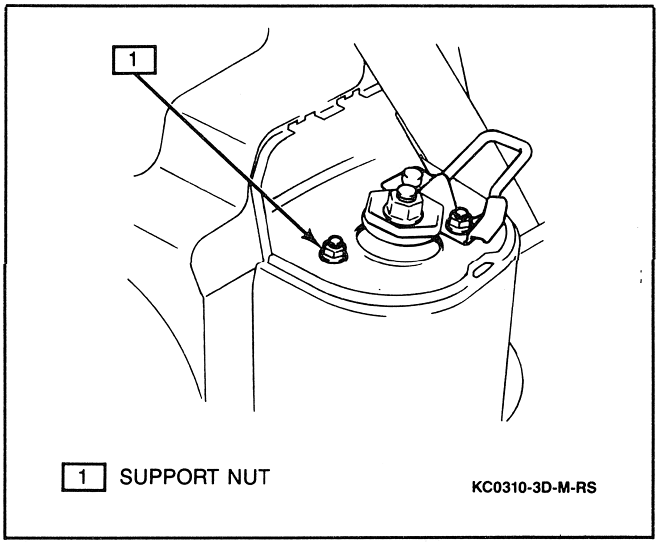

1
1 SUPPORT NUT
KC0310-3D-M-RS

Figure 31 Strut Support Nut Installation

5. Remove jack from under suspension arm.
6. Wheel.
7. Lower hoist.

REAR SUSPENSION KNUCKLE

Figures 32 through 44

Remove or Disconnect

1. Brake drum. For information on this system, refer to BRAKES (Section 5).
2. Brake hose bracket from knuckle (Figure 32).

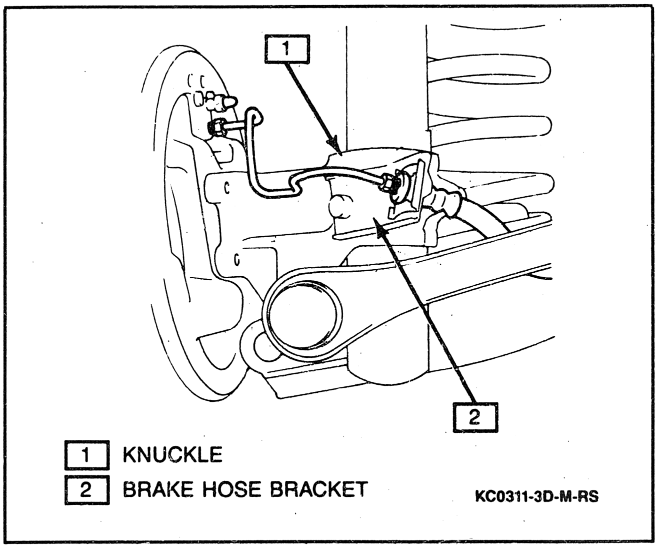

1 KNUCKLE
2 BRAKE HOSE BRACKET
KC0311-3D-M-RS

Figure 32 Brake Hose Bracket From Knuckle

3. Brake pipe from wheel cylinder and put wheel cylinder breather plug cap onto pipe to prevent fluid from spilling (Figure 33).

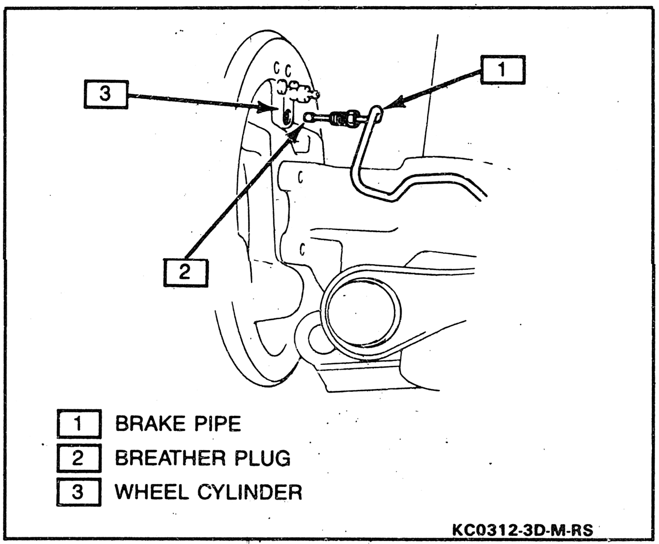

1 BRAKE PIPE
2 BREATHER PLUG
3 WHEEL CYLINDER
KC0312-3D-M-RS

Figure 33 - Brake Pipe From Wheel Cylinder

4. Brake back plate from knuckle after first removing four plate bolts (Figure 34).
5. Place jack under suspension arm to prevent it from lowering.
6. Nut and washer from inside (body center side) of control rod.

NOTICE: As a preparatory step for this removal, check stamped line on washer to use for guide in reinstallation. Refer to "Suspension Arm Removal" earlier in this section.

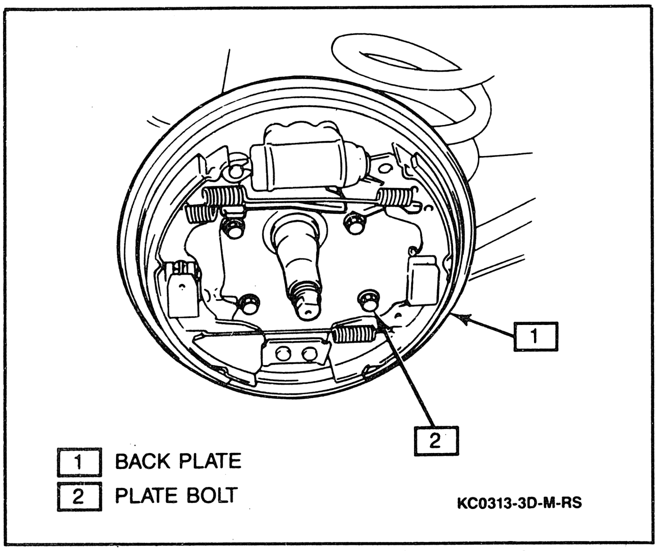

1 BACK PLATE
2 PLATE BOLT
KC0313-3D-M-RS

Figure 34 Brake Back Plate Removal

7. Outside (Figure 35).

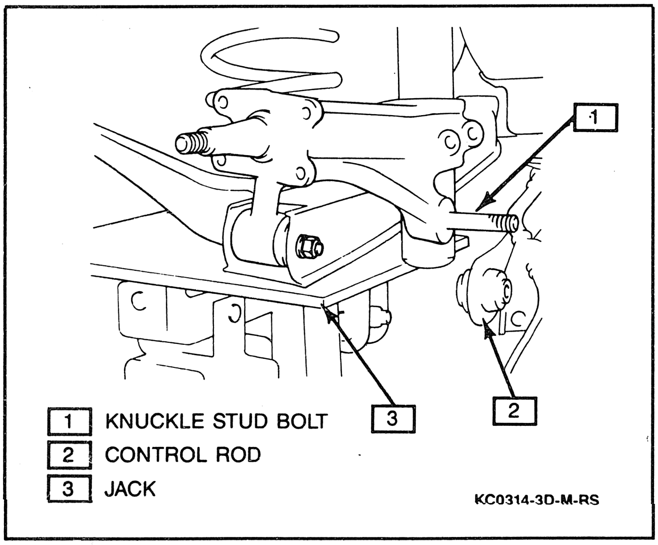

1 KNUCKLE STUD BOLT
2 CONTROL ROD
3 JACK
KC0314-3D-M-RS

Figure 35 Control Rod From Knuckle Stud Bolt

8. Strut lower mount bolt (Figure 36).
9. Knuckle lower mount bolt (Figure 37).
10. Knuckle from suspension arm and knuckle from strut.

NOTICE: If it is hard to remove knuckle from strut, open slit of knuckle by inserting a wedge. Don't open slit wider than necessary (Figure 38).

Install or Connect

1. Knuckle to strut. Align projection "A" on strut against slit of knuckle and push strut into knuckle until upper end of knuckle contacts "B" on strut (Figure 39).
2. Strut lower mount bolt.

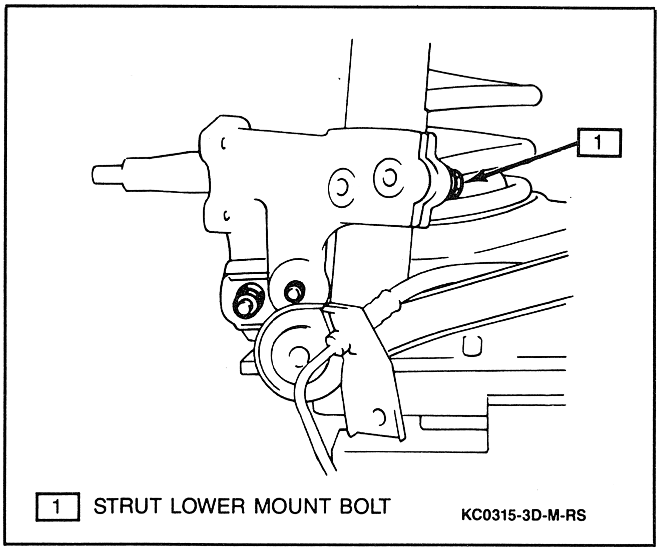

1
1 STRUT LOWER MOUNT BOLT
KC0315-3D-M-RS

Figure 36 Strut Lower Mount Bolt Removal

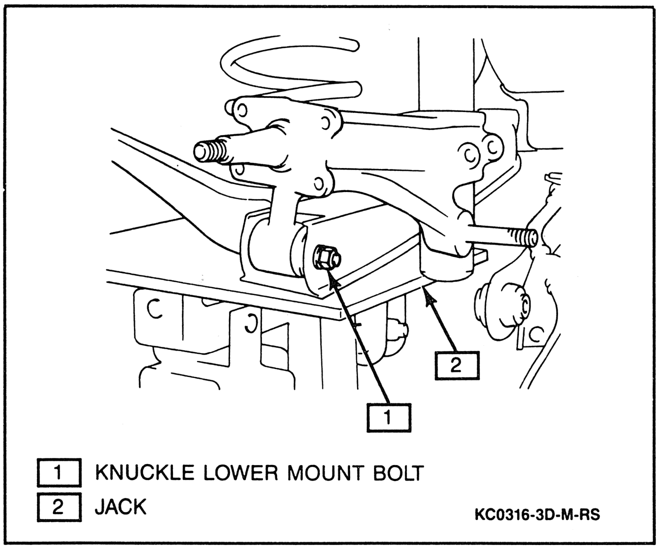

2
1
1 KNUCKLE LOWER MOUNT BOLT
2 JACK
KC0316-3D-M-RS

Figure 37 Knuckle Lower Mount Bolt Removal

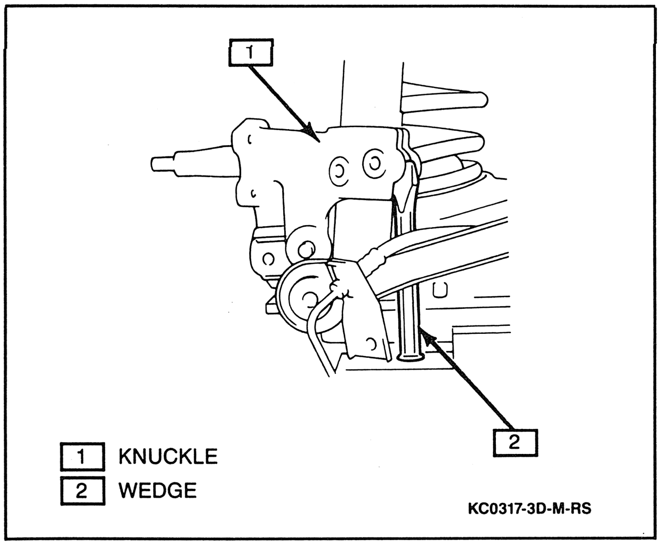

1
2
1 KNUCKLE
2 WEDGE
KC0317-3D-M-RS

Figure 38 Knuckle From Strut Removal

3. Lower mount end of knuckle to suspension arm (Figure 40).

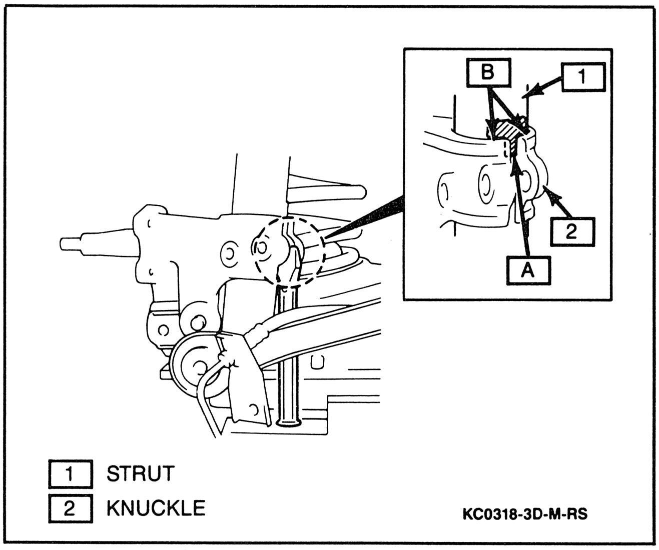

B
1
2
A
1 STRUT
2 KNUCKLE
KC0318-3D-M-RS

Figure 39 Knuckle to Strut Installation

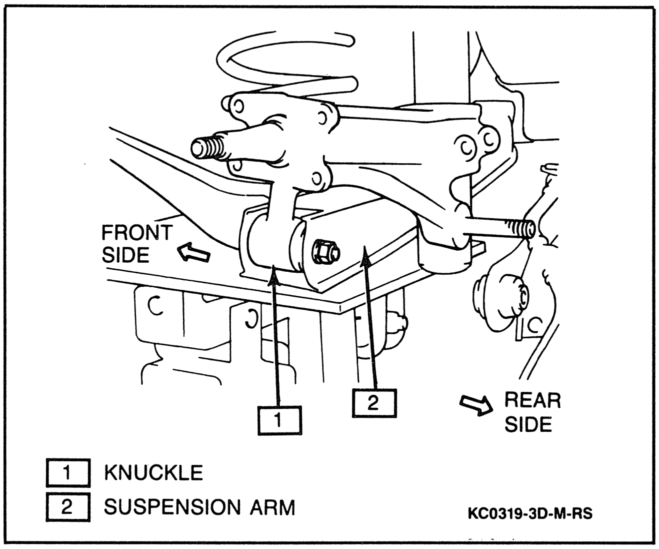

FRONT SIDE
REAR SIDE
1
2
1 KNUCKLE
2 SUSPENSION ARM
KC0319-3D-M-RS

Figure 40 Knuckle to Suspension Arm

Tighten

- Strut lower mount nut to 60 N•m (44 lb. ft.)

4. Remove jack from under suspension arm.

Tighten

- Knuckle lower mount nut to 50 N•m (37 lb. ft.).

5. Apply GM Sealer #10527751 to mating surface of brake back plate and rear knuckle (See Figure 42).
6. Brake back plate (Figure 43).

Tighten

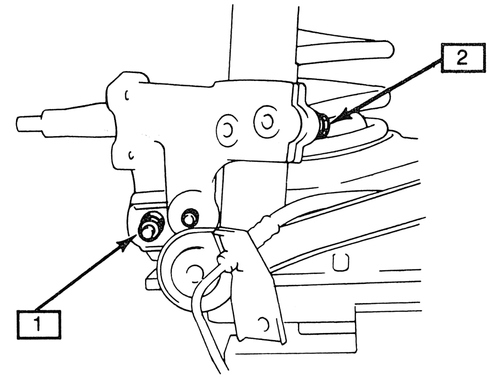
- Back plate bolts to 23 N•m (17 lb. ft.).

7. Brake hose bracket to knuckle (Figure 44).

Tighten

- Tighten brake pipe flare nut to 16 N•m (12 lb.ft.).

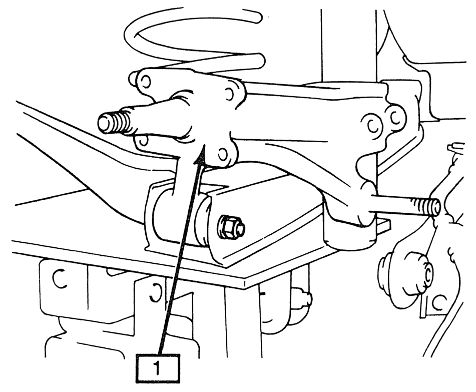
8. Breather plug cap to breather plug (Figure 44).



1 KNUCKLE LOWER MOUNT NUT
2 STRUT LOWER MOUNT NUT

KC0320-3D-M-RS

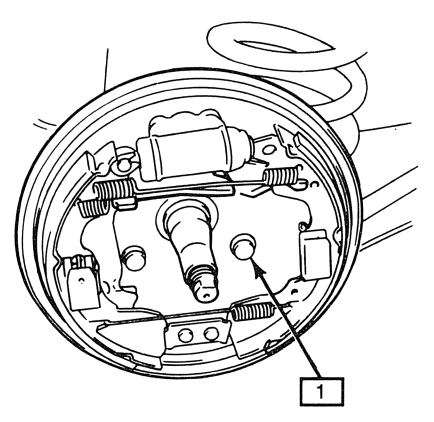
Figure 41 Knuckle/Strut Lower Mount Nuts



1 APPLY WATER-TIGHT SEALANT G.M. #1052751

KC0321-3D-M-RS

Figure 42 Rear Knuckle Mating Surface

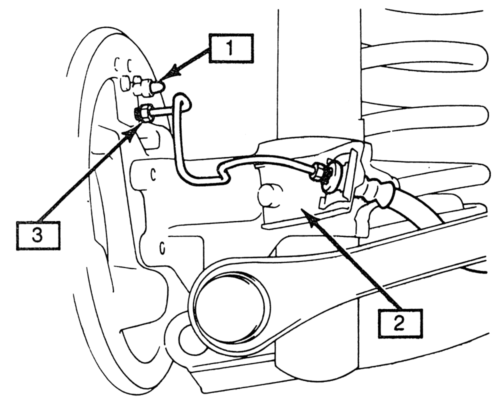


1 PLATE BOLT

KC0322-3D-M-RS

Figure 43 Brake Back Plate Installation

9. Brake drum. For information on the brake system, refer to BRAKES (Section 5).



1 BREATHER PLUG CAP
2 HOSE BRACKET
3 FLARE NUT

KC0323-3D-M-RS

Figure 44 Breather Plug Cap Installation

10. Control rod and control rod nuts (inside and outside), but do not torque.

11. Fill reservoir with brake fluid and bleed brake system. For information on bleeding this brake system, refer to BRAKES (Section 5).

Adjust

- Foot brake by pressing brake pedal with 30 kg (66 lbs) load three to five times to obtain proper drum-to-shoe clearance.
- Parking brake cable. For information on this brake system, refer to BRAKES (Section 5).

Tighten

- Parking brake lever cover screws.

12. Wheel.

Inspect

- To ensure that brake drum is free from dragging and proper braking is obtained.

13. Lower hoist.

Tighten

- Outside/inside nuts of control rod to 80 N·m (59 lb. ft.)

NOTICE: When tightening inside nut, refer to "Control Rod Installation" in this section. Then check toe.

14. Perform brake test (foot brake and parking brake).

15. Check each installed part for fluid leakage.

WHEEL BEARING

Figures 45 through 48

Remove or Disconnect

1. Brake drum. For information on the brake system, refer to BRAKES (Section 5).
2. Wheel bearing, using a brass drift punch and hammer (Figure 45).

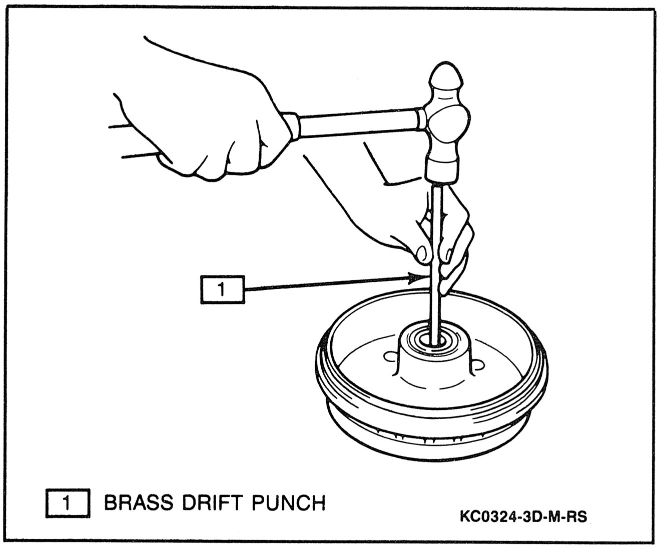


Figure 45 Wheel Bearing Removal

Install or Connect

1. Wheel bearing using special tools J34842 and J8092 (Figure 46).

   Important

   When installing bearings:

   - For installing direction of spacer, spacer fits correctly only one way (Figure 47).
   - Direct both inner bearing and outer bearing sealed side outward.
   - Fill space indicated by "A" with bearing grease as much as 40% of space capacity (Figure 47).

2. Brake drum and wheel. For information on the brake system, refer to BRAKES (Section 5).

WHEEL STUD

Remove or Disconnect

1. Brake drum. For information on the brake system, refer to BRAKES (Section 5).

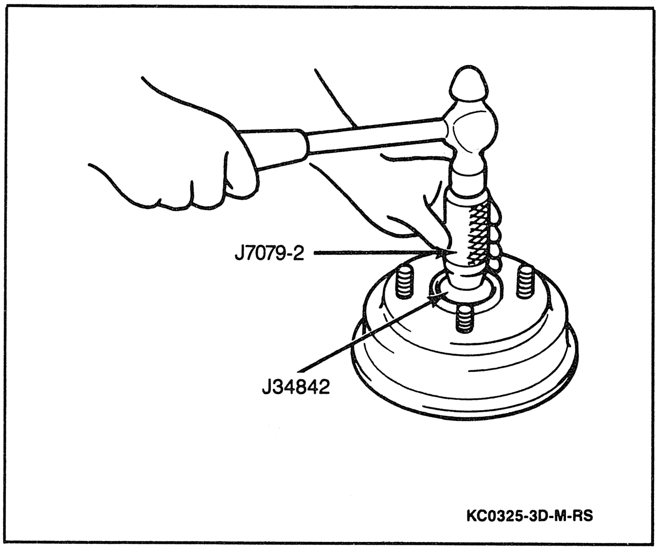


Figure 46 Wheel Bearing Installation

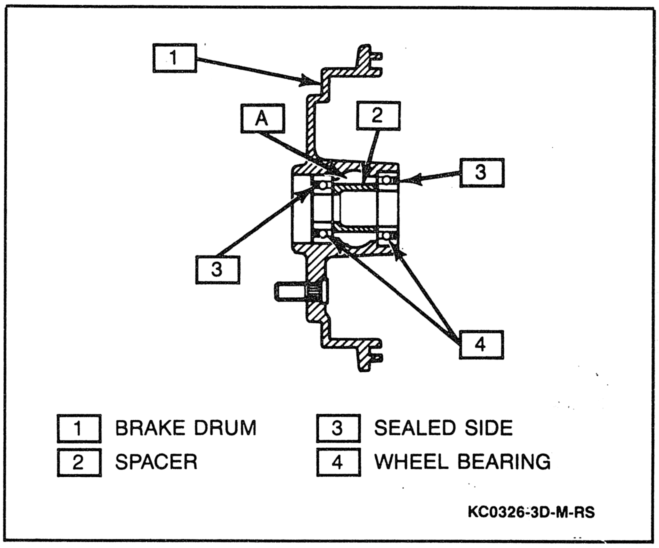


Figure 47 Brake Drum Cross Section

2. Wheel studs using a hydraulic press and rod (Figure 48).

Install or Connect

1. Wheel studs using hydraulic press and rod (Figure 48).

   NOTICE: Insert new stud in drum hole and rotate drum slowly to ensure serrations are aligned with those made by the replaced bolt.

2. Brake drum. For information on the brake system, refer to BRAKES (Section 5).

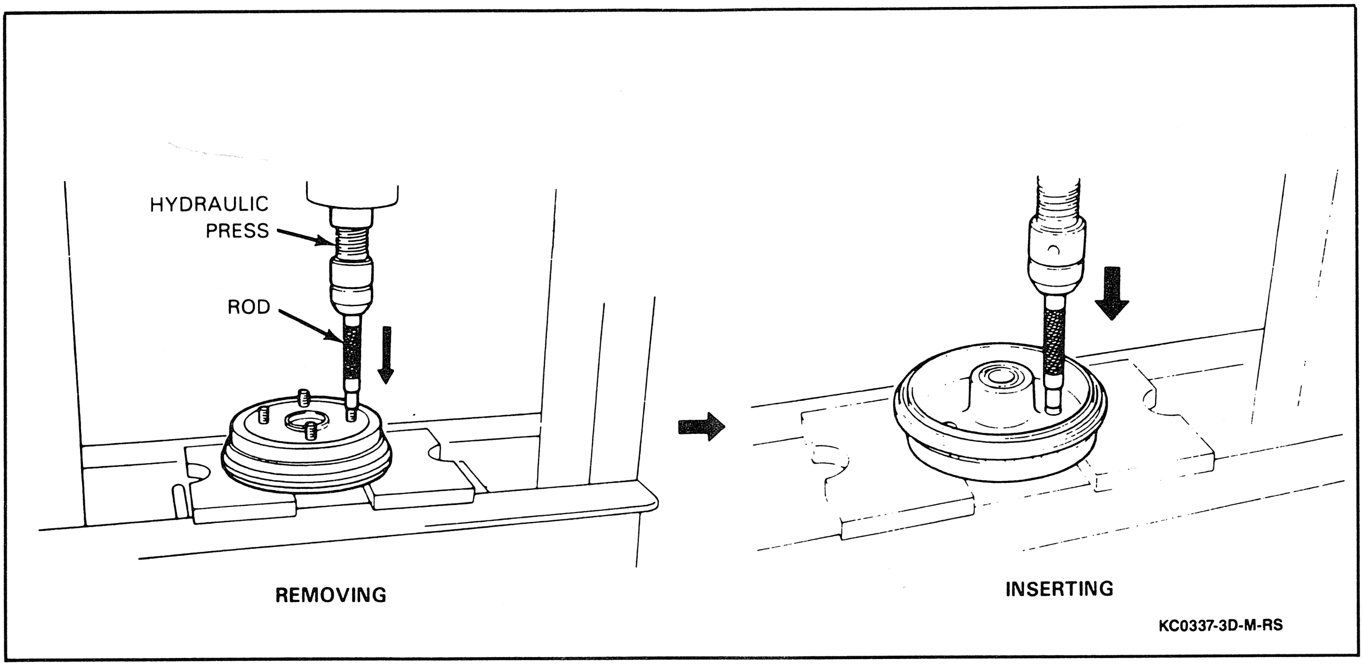


Figure 48 Wheel Stud Removal and Installation

INSPECTION

STRUT DAMPER

Figure 49

Inspect

1. Strut for oil leakage. If strut is found fauly, replace it as an assembly unit, because it cannot be disassembled (Figure 49).

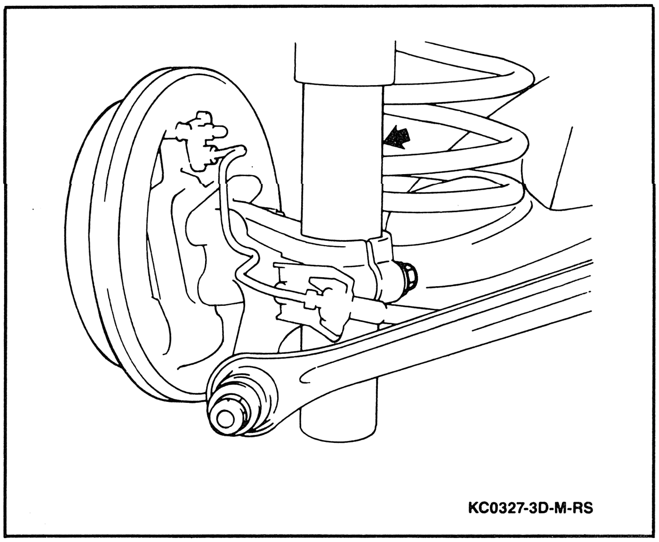


Figure 49 Strut Assembly

2. Strut function. Check and adjust tire pressures as specified. Bounce car body three or four times continously by pushing rear end on the side with strut to be checked. Apply the same amount of force at each push and note strut resistance both when pushed and rebounding. Also, note how many times car body rebounds before coming to a stop after hands are off. Do the same for strut on the other side. Compare strut resistance and number of rebounds on the right with those on the left. They must be equal in both. With proper strut, car body should come to a stop the moment hands are off or after only one or two small rebounds. If struts are suspected, compare them with known good car or strut.
3. For damage or deformation.
4. For abnormal noise.
5. For cracks or deformation in spring seat.
6. For deterioration of bump stopper.
7. Strut mount for wear, cracks or deformation. Replace any parts found defective.

SUSPENSION ARM, COIL SPRING AND KNUCKLE ARM

Figure 50

Inspect

1. For cracks, deformation or damage.
2. Bushing for damage, wear or breakage. Replace any defective part.

CONTROL ROD

Inspect

1. For cracks, deformation or damage.
2. Bushings for wear and breakage. Replace any defective part.

REAR SUSPENSION FASTENERS

Inspect

1. Each bolt and nut to its proper torque.

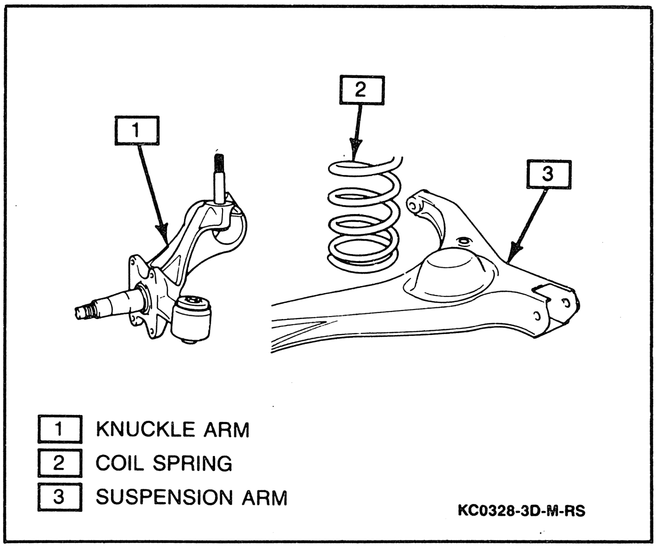

1
2
3
1 KNUCKLE ARM
2 COIL SPRING
3 SUSPENSION ARM
KC0328-3D-M-RS

Figure 50 Suspension Arm, Coil Spring, and Knuckle Arm

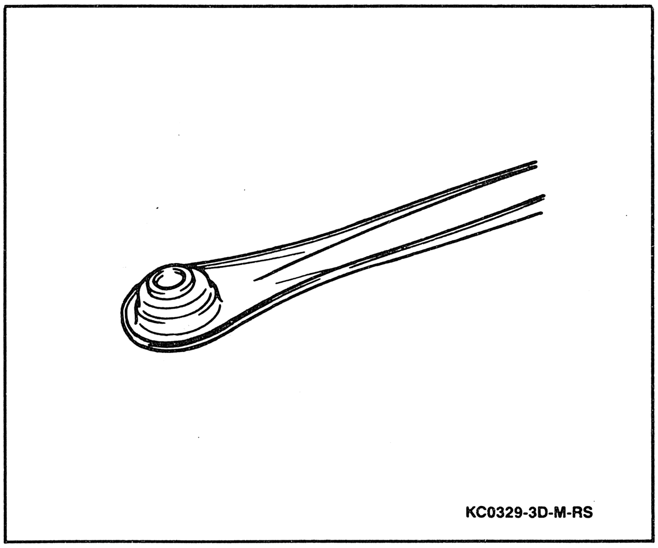

KC0329-3D-M-RS

Figure 51 Control Rod Busing

WHEEL DISC, NUT AND BEARING

Figures 52 and 53

Inspect

1. Each wheel disc for dents, distortion and cracks. A disc in badly damaged condition must be replaced.
2. Wheel hub nuts for tightness and, as necessary, retighten to specification.
3. Wheel bearings for wear.
4. Measure wheel thrust play by applying a dail gage to spindle cap center.
5. Rear thrust play limit is 0.3 mm (0.012 in).

When measurement exceeds limit, replace bearing. Refer to "Wheel Bearing Replacement" earlier in this section.

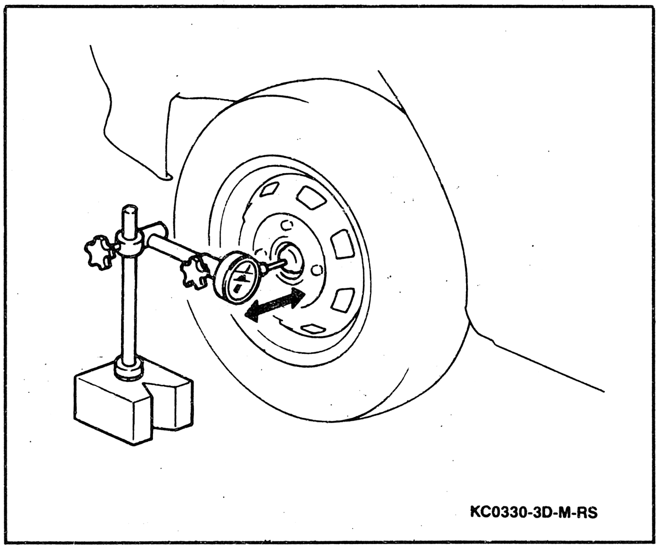

KC0330-3D-M-RS

Figure 52 Measuring Thrust Play

6. Wheel bearing for noise and smooth rotation by rotating wheel. If it is defective, replace wheel bearing.

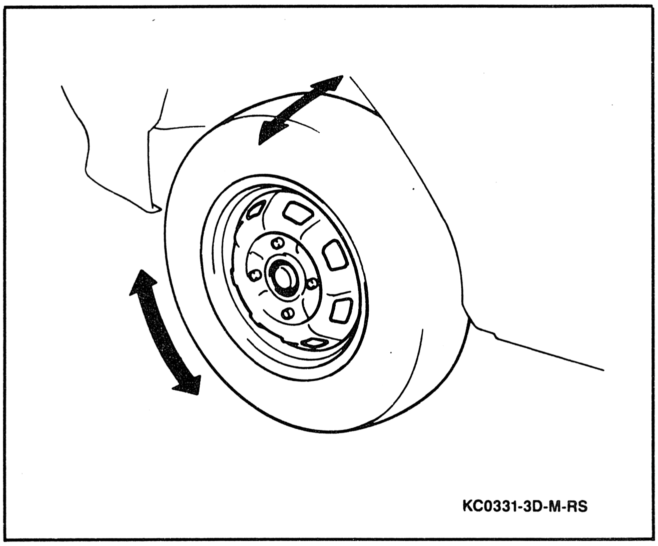
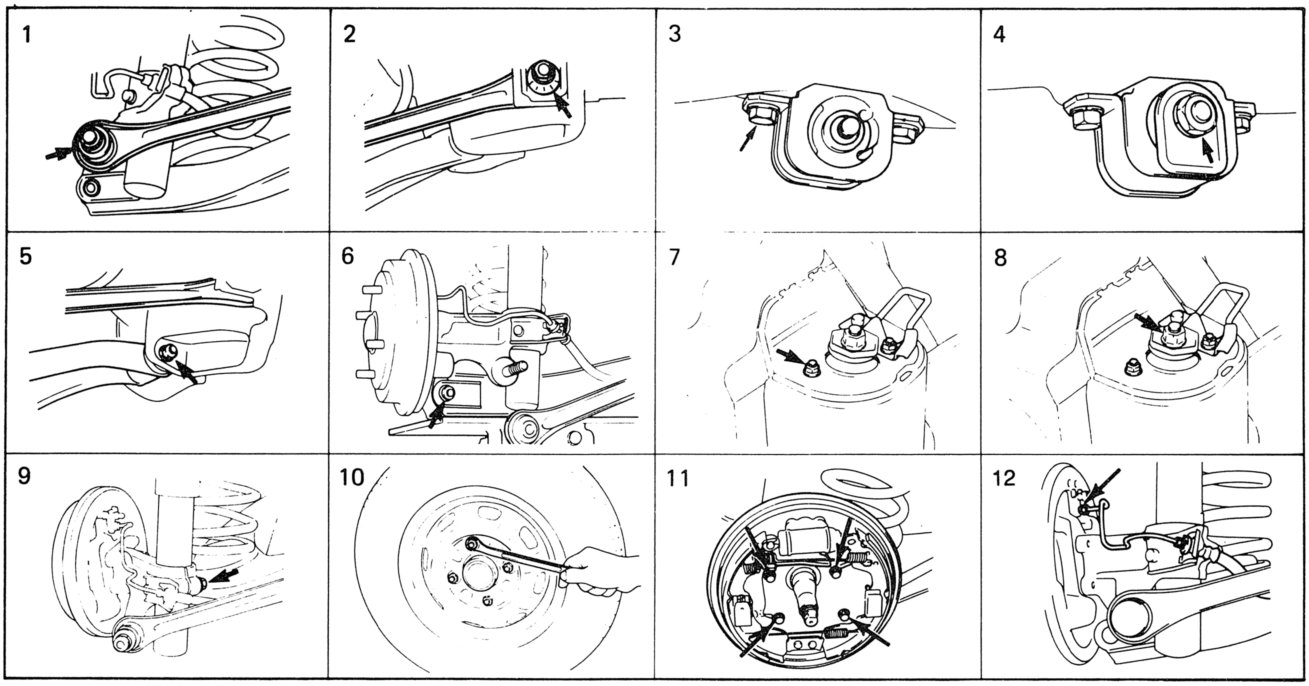


Figure 53 Bearing Rotation

TORQUE SPECIFICATIONS

Control rod outside nut	80 N·m (59 lb.ft.)
Control rod inside nut	80 N·m (59 lb.ft.)
Suspension arm mounting bolt bracket	45 N·m (33 lb.ft.)
Suspension arm front nut	60 N·m (44 lb.ft.)
Suspension arm rear nut	50 N·m (37 lb.ft.)
Knuckle arm lower mount nut	50 N·m (37 lb.ft.)
Strut support nut	33 N·m (24 lb.ft.)
Strut upper nut	50 N·m (37 lb.ft.)
Strut lower mount bolt	60 N·m (44 lb.ft.)
Wheel nut	60 N·m (44 lb.ft.)
Back plate bolts	23 N·m (17 lb.ft.)
Brake pipe flare nuts	16 N·m (12 lb.ft.)



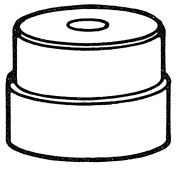
KC0335-3D-M-RS

SERVICE MATERIALS

Materials	Recommended Product	Use
Brake Fluid	GM Brake Fluid #1052535	Brake reservoir tank
Water tight sealant	GM Silicone Sealer (RTV) #1052751	Joint seam of knuckle and brake back plate

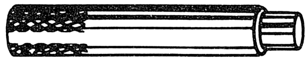
SPECIAL TOOLS

1



J34842
REAR WHEEL BEARING INSTALLER

2



J7079-2
NON-THREADED UNIVERSAL DRIVER HANDLE

KC0336-3D-M-RS

SECTION 3E

WHEELS AND TIRES

NOTICE: When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part fastener is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are not reused, and those requiring thread locking compound will be called out. The correct torque value must be used when installing fasteners that require it. If the above conditions are not followed, parts or system damage could result.

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GENERAL DESCRIPTION

TIRES

All models are equipped with metric sized (P145/80R 12) steel belted radial tires.

The tires are designed to operate satisfactorily with loads up to the full rated load capacity when inflated to the recommended inflation pressures.

Correct tire pressures and driving habits have an important influence on tire life. Heavy cornering, excessively rapid acceleration, and unnecessary sharp braking increase tire wear.

WHEELS

Standard equipment wheels are 4.00B x 12 inch steel wheels.

Replacement Metric Tires

Metric tire size format is shown in Figure 3E-1. When replacement is necessary, the original equipment type tire should be used. Refer to the Tire Placard.

Most metric tire sizes do not have exact corresponding alphanumeric tire sizes. Replacement tires should be of the same size, load range and construction as those originally on the car. Use of any other size or type tire may affect ride handling, speedometer/odometer calibration, vehicle ground clearance and tire or snow chain clearance to the body and chassis.

NOTICE: Do not mix different types of tires on the same car such as radial, bias and bias-belted tires except in emergencies, because car handling may be seriously affected and may result in loss of control.

It is recommended that new tires be installed in pairs on the same axle. If necessary to replace only one tire, it should be paired with the tire having the most tread, to equalize braking traction.

The metric term for tire inflation pressure is the kilopascal (kPa). Tire pressures will usually be printed in both kPa and psi on the Tire Placard. Metric tire gages are available from tool suppliers. The chart, Figure 3E-2, converts commonly used inflation pressures from kPa to psi.

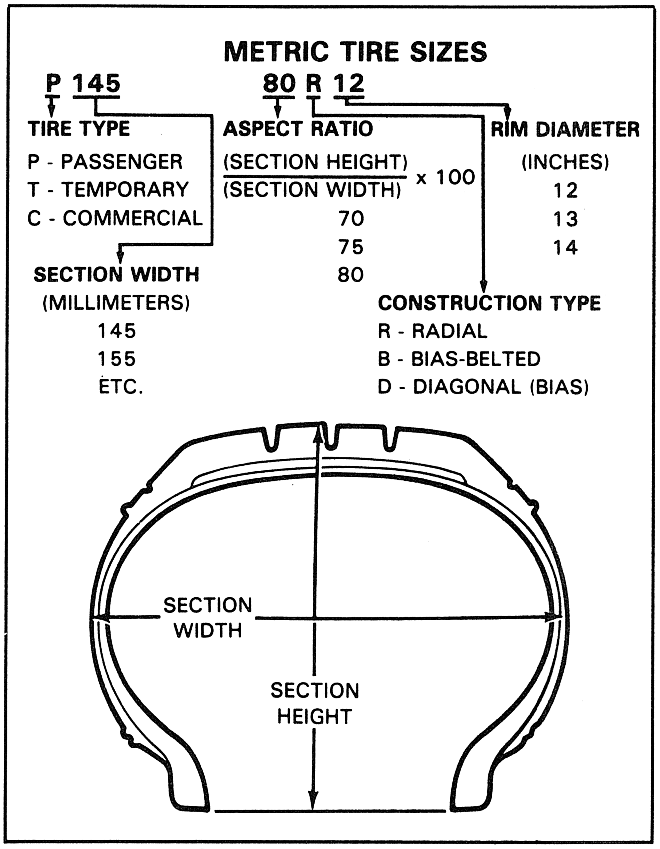

METRIC TIRE SIZES
P 145 80 R 12
TIRE TYPE
P - PASSENGER
T - TEMPORARY
C - COMMERCIAL
ASPECT RATIO
(SECTION HEIGHT) / (SECTION WIDTH) x 100
70
75
80
RIM DIAMETER
(INCHES)
12
13
14
SECTION WIDTH
(MILLIMETERS)
145
155
ETC.
CONSTRUCTION TYPE
R - RADIAL
B - BIAS-BELTED
D - DIAGONAL (BIAS)
SECTION WIDTH
SECTION HEIGHT

Figure 3E-1 - Metric Tire Size Format

kPa	PSI	kPa	PSI
140	20	215	31
145	21	220	32
155	22	230	33
160	23	235	34
165	24	240	35
170	25	250	36
180	26	275	40
185	27	310	45
190	28	345	50
200	29	380	55
205	30	415	60

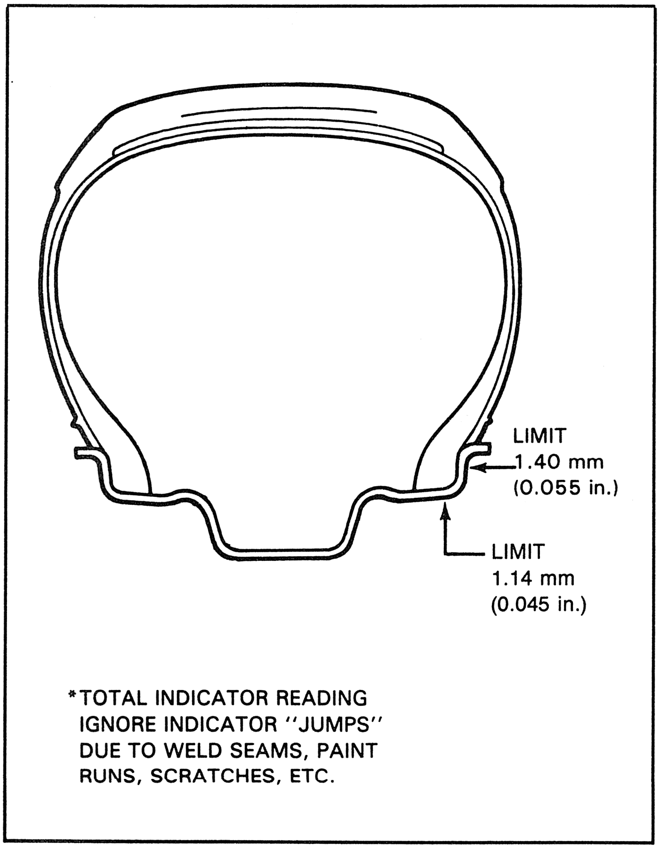
Conversion: 6.9 kPa = 1 psi

Figure 3E-2 - Tire Pressure Conversion Chart

Replacement Wheels

Wheels must be replaced if they are bent, dented, have excessive lateral or radial runout, leak air through welds, have elongated bolt holes, if lug nuts won't stay tight, or if they are heavily rusted. Wheels with greater runout than shown in Figure 3E-3 may cause objectional vibrations.

Replacement wheels must be equivalent to the original equipment wheels in load capacity, diameter, rim width, offset and mounting configuration. A wheel of improper size or type may affect wheel and bearing life, brake cooling, speedometer/odometer calibration, car ground clearance and tire clearance to the body and chassis.


LIMIT
1.40 mm
(0.055 in.)
LIMIT
1.14 mm
(0.045 in.)

*TOTAL INDICATOR READING
IGNORE INDICATOR "JUMPS"
DUE TO WELD SEAMS, PAINT
RUNS, SCRATCHES, ETC.

Figure 3E-3 - Wheel Runout

TIRE PLACARD

The tire placard is located on the left door lock pillar and should be referred to for tire information. The placard lists the maximum load, tire size and cold tire pressure where applicable.

MAINTENANCE AND MINOR ADJUSTMENTS

WHEEL REPAIR

Wheel repairs that use welding, heating, or peening are not approved. All damaged wheels should be replaced.

WHEEL ATTACHING STUDS

If a broken stud is found, see Section 3D (rear) or Section 3C (front) for Notice and Replacement procedure.

MATCHED TIRES AND WHEELS

Tires and wheels are "match-mounted" at the assembly plant. This means that the radially stiffest part of the tire, or "high spot", is matched to the smallest radius or "low spot" of the wheel. This is done to provide the smoothest possible ride.

The "high spot" of the tire is originally marked by a paint dot on the outboard sidewall. This paint dot will eventually wash off of the tire.

The "low spot" of the wheel is originally marked by a paint dot on the wheel rim-flange. Properly assembled, the wheel 'rims' paint dot should be aligned with the tires' paint dot, Figure 3E-4.

Whenever a tire is dismounted from its wheel, it should be remounted so that the tire and wheel are matched. If the tire's paint dot cannot be located, a line should be scribed on the tire and wheel before dismounting to assure that it is remounted in the same position.

INFLATION OF TIRES

The pressure recommended for any model is carefully calculated to give a satisfactory ride, stability, steering, treadwear, tire life and resistance to bruises.

Tire pressure, with tires cold, (after car has set for three hours or more, or driven less than one mile) should be checked monthly or before any extended trip. Set to the specifications on the tire placard located on the left door lock pillar. It is normal for tire pressure to increase 28 kPa (4 psi) when the tires become hot during driving. **Do not** bleed or reduce tire pressure after driving. Bleeding reduces the "Cold Inflation Pressure".

Higher than recommended pressure can cause:

1. Hard ride.
2. Tire bruising or carcass damage.
3. Rapid tread wear at center of tire.

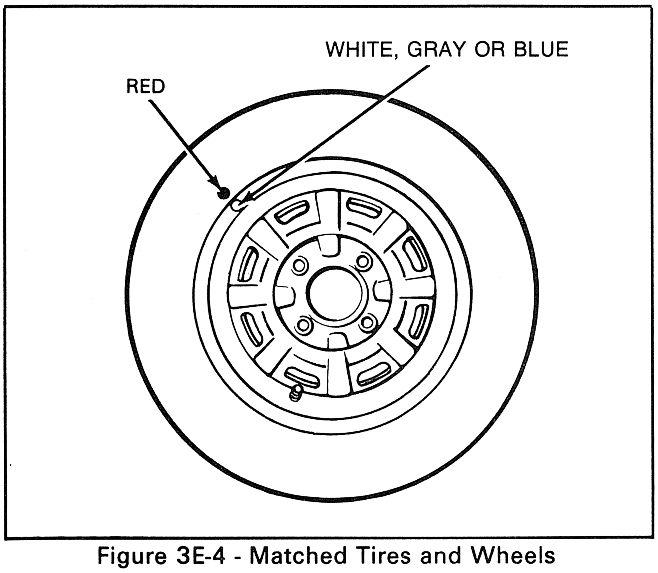


Figure 3E-4 - Matched Tires and Wheels

Lower than recommended pressure can cause:

1. Tire squeal on turns.
2. Hard Steering.
3. Rapid and uneven wear on the edges of the tread.
4. Tire rim bruises and rupture.
5. Tire cord breakage.
6. High tire temperatures.
7. Reduced handling.
8. Reduced fuel economy.

Unequal pressure on same axle can cause:

1. Uneven braking.
2. Steering lead.
3. Reduced handling.
4. Swerve on acceleration.

Valve caps should be on the valves to keep dust and water out.

TIRE ROTATION

To equalize wear, rotate tires according to Figure 3E-6. Radial tires should be rotated at the first 12 000 km (7,500 miles) and after that, tire rotation at least every 7,500 miles is recommended. Set tire pressure.

NOTICE: Due to their design, radial tires tend to wear faster in the shoulder area, particularly in front positions. This makes regular rotation especially necessary.

TIRE CHAIN USAGE

Due to limited tire-to-body clearance on certain vehicles, tire chain usage recommendations have been published in the Owner's Manual. When chains are to be used, most current GM vehicles require SAE Class "S" tire chains. These may also be designated as 1100 Series, Type PL tire chains. These chains are specially designed to limit the "fly off" effect that occurs when the wheel rotates.

Manufacturers of tire chains have a specific chain size for each tire size to ensure proper fit when installed. Therefore, be sure to purchase the correct chains for the tires on which they are to be used. Rubber adjusters should not be used to take up slack or clearance in chains which are loose due to incorrect size. Always follow the chain manufacturers installation instructions.

Use of chains may adversely affect vehicle handling. When using chains:

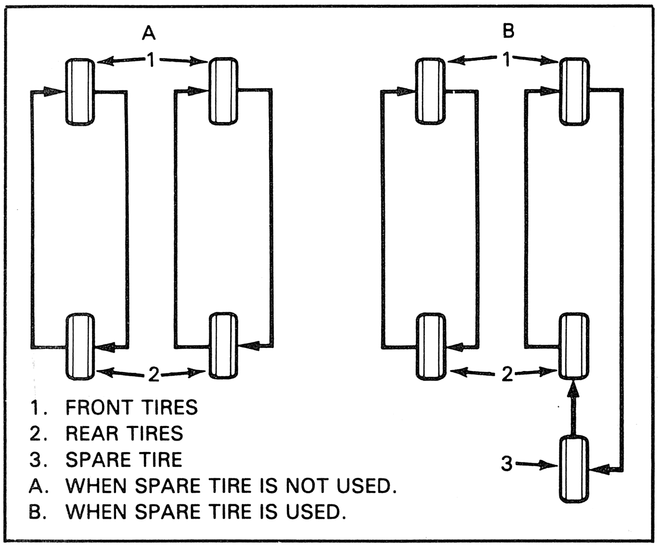
- Adjust speed to road conditions
- Avoid sharp turns
- Avoid locked-wheel braking

In general, to help prevent chain damage to your car:

- Install the chains on the front tires as tightly as possible, then tighten them again after driving 1/4 to 1/2 mile (0.4 to 0.8 kilometer). The use of chains on the rear tires is not recommended; the chains may contact and possibly damage the car. If you intend to use chains on the rear tires, be sure there is enough clearance.

- Do not exceed 45 mph (70 km/h), or the chain manufacturer's speed limit, if lower.
- Drive in a restrained manner and avoid large bumps, potholes, severe turns and other maneuvers which could cause the tires to bounce up and down.
- Follow any other instructions of the chain manufacturer which do not disagree with the above.

Additional specific information is published in the Owner's Manual.



1. FRONT TIRES
2. REAR TIRES
3. SPARE TIRE

A. WHEN SPARE TIRE IS NOT USED.
B. WHEN SPARE TIRE IS USED.

Figure 3E-5 Tire Rotation

SERVICE OPERATIONS

METRIC WHEEL NUTS AND WHEEL STUDS

All models use metric nuts and wheel studs (size M10 x 1.25).

WHEEL

Remove or Disconnect

1) Loosen wheel nuts by approximately 180° (half a rotation).
2) Hoist vehicle.
3) Wheel nuts and wheel.

NOTICE: Never use heat to loosen a tight wheel nut. The application of heat to the wheel can shorten the life of the wheel and damage wheel bearings.

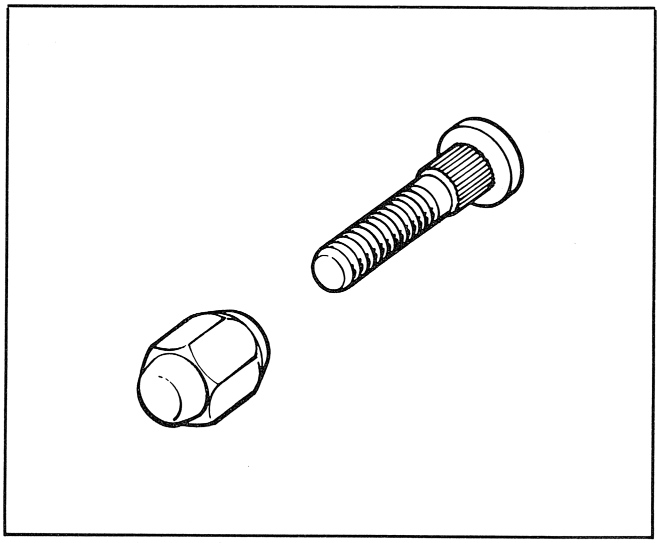


Figure 3E-6 - Metric Stud and Nut

TORQUE SPECIFICATION

Wheel nuts: 60 N·m (44 lb ft.)

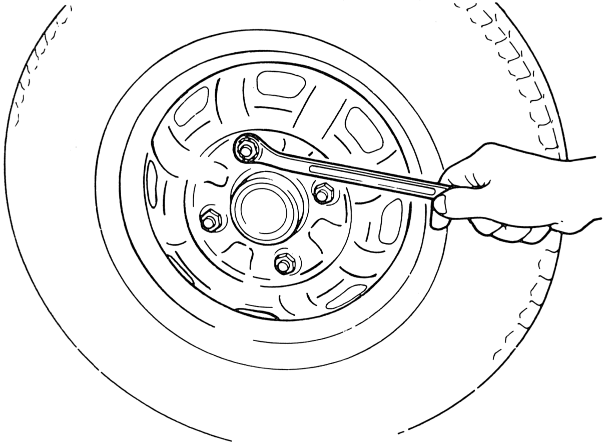


Figure 3E-6 Wheel Nut Installation

Wheel nuts must be tightened in sequence and proper torque to avoid bending wheel or brake drum or disc, Figure 3E-7.

Install or Connect

NOTICE: Before installing wheels, remove any build-up of corrosion on the wheel mounting surface and brake drum or disc mounting surface by scraping and wire brushing. Installing wheels without good metal-to-metal contact at the mounting surfaces can cause wheel nuts to loosen, which can later allow a wheel to come off while the car is moving.

1. Wheel and wheel nuts.

Tighten

- Wheel nuts to 60 N·m (44 lb. ft.).

Important

- Wheel nuts must be tightened in sequence and to proper torque to avoid bending wheel, brake drum, or disc, Figure 3E-7.

2. Lower vehicle.

NOTICE: Wheel alignment and matching of tread wear should be checked and adjusted if necessary.

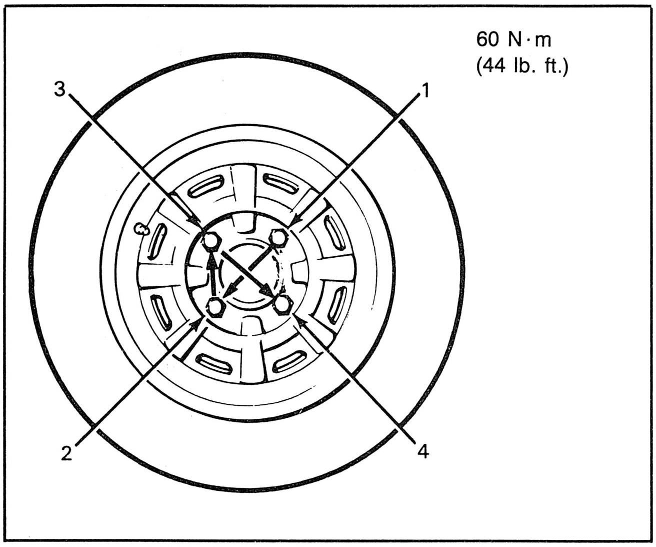


Figure 3E-7 - Wheel Nut Tightening Sequence

TIRE MOUNTING AND DEMOUNTING

Use a tire changing machine to mount or demount tires. Follow the equipment manufacturer's instructions. Do not use hand tools or tire irons alone to change tires as they may damage the tire beads or wheel rim.

Rim bead seats should be cleaned with a wire brush or coarse steel wool to remove lubricants, old rubber and light rust. Before mounting or demounting a tire, the bead area should be well lubricated with an approved tire lubricant.

After mounting, inflate tire to 240 kPa (35 psi) so that beads are completely seated. Install valve core and inflate to pressure recommended on tire label.

CAUTION: Do not stand over tire when inflating. Bead may break when bead snaps over rim's safety hump and cause serious personal injury.

Do not exceed 240 kPa (35 psi) pressure when inflating. If 240 kPa (35 psi) pressure will not seat beads, deflate, re-lubricate and reinflate. Over-inflation may cause the bead to break and cause serious personal injury.

TIRE REPAIR

There are many different materials on the market to repair tires. Manufacturers have published detailed instructions on how and when to repair tires. These instructions can be obtained from the tire manufacturer.

MEASURING WHEEL RUNOUT

Wheel runout should be measured with an accurate dial indicator. Measurements may be taken with wheel installed on or off the vehicle using an accurate mounting surface such as on a wheel balancer. Measurements may also be taken with or without the tire mounted on the wheel.

Radial runout and lateral runout should be measured on both the inboard rim flanges. With the dial indicator firmly in position, slowly rotate the wheel one revolution and record the total indicator reading. If any measurement exceeds specifications, and there is a vibration that wheel balancing will not correct, the wheel should be replaced. Disregard any indicator readings due to welds, paint runs, scratches, etc., Figure 3E-3.

SPARE TIRE

Compact Spare

CAUTION: All models are equipped with a high pressure compact spare (T105/8013) located in the rear tailgate storage area. Replacement of this wheel must consist of an equivalent to the originally equipped wheel in load, capacity, diameter, rim width, offset and mounting configuration. A wheel of improper size may result in loss of control, personal injury, or property damage.

NOTICE: The compact spare tire wheel should not be used with standard tires, snow tires, wheel covers, or trim rings. If such use is attempted, damage to these items or other parts of the vehicle may occur. The compact spare should only be used on vehicles which offered it as original equipment.

Inflation pressure of the compact spare must be periodically checked and maintained at 420 kPa (60 psi). It can be mounted and dismounted from its wheel using present tire changing procedures. As with other tires, the beads should completely seat at 275 kPa (40 psi). The tire may then be safely inflated to 420 kPa (60 psi).

BALANCING WHEELS AND TIRES

There are two types of wheel and tire balance, static and dynamic. Static balance, Figure 3E-8, is the equal distribution of weight around the wheel. Assemblies that are statically, unbalanced cause a bouncing action called tramp. This condition will eventually cause uneven tire wear.

Dynamic balance, Figure 3E-9, is the equal distribution of weight on each side of the wheel centerline so that when the tire spins there is no tendency for the assembly to move from side to side. Assemblies that are dynamically unbalanced may cause shimmy.

General Balance Procedures

Deposits of mud, etc. must be cleaned from the inside of the rim.

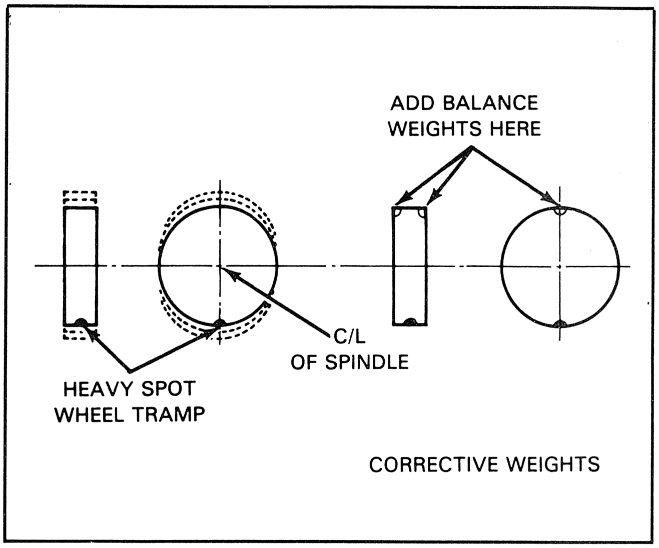


Figure 3E-8 - Static Unbalance Correction

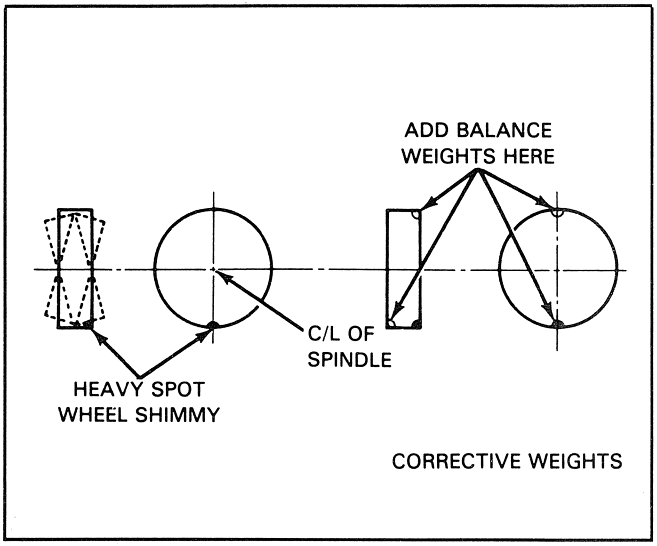


Figure 3E-9 - Dynamic Unbalance Correction

CAUTION: Stones should be removed from the tread to avoid operator injury during spin balancing and to obtain a good balance.

Each tire should be inspected for damage, then balanced according to the equipment manufacturer's recommendation.

Off-Car Balancing

Most electronic off-car balancers are more accurate than the on-car spin balancers. They are easy to use and give a dynamic (two plane) balance. Although they do not correct for drum or disc unbalance as does on-car spin balancing, this is overcome by their accuracy.

On-Car Balancing

On-car balancing methods vary with equipment and tool manufacturers. Be sure to follow each manufacturer's instructions during balancing operation.

CAUTION: The wheel spin should be limited to 35 mph (55 km/h) as indicated on the speedometer. This limit is necessary because the speedometer only indicates one-half on the actual wheel speed when one drive wheel is spinning and the other drive wheel is stopped. Unless care is taken in limiting drive wheel spin, the spinning wheel can reach excessive speeds. This can result in possible tire disintegration or differential failure, which could cause serious personal injury or extensive car damage.

CORRECTION OF NON-UNIFORM TIRES

If a replacement tire cannot be obtained, there are several ways to correct tires which cause a vibration even though they are properly balanced. The best method uses in automatic machine which loads the tire and buffs small amounts of rubber from selected spots on the outer two tread rows. This method should be followed by an accurate electronic off-car wheel balance. Correction by this method is usually permanent and, if done properly, does not significantly affect the appearance or tire tread life. Tire truing with a blade-type machine is not recommended as this reduces the tread life substantially and often does not permanently correct the problem.

Another method is to dismount the tire and rotate it 180 degrees on the rim. It is important that this be done on tire assemblies which are known to be causing a vibration as it is just as likely to make good assemblies worse.

TORQUE SPECIFICATION

Wheel nuts ....60 N·m (44 lb. ft.)

SECTION 3F

STEERING WHEEL AND COLUMN

NOTICE: When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are reused, and those requiring thread locking compound will be called out. The correct torque value must be used when installing fasteners that require it. If the above conditions are not followed, parts or system damage could result.

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GENERAL DESCRIPTION

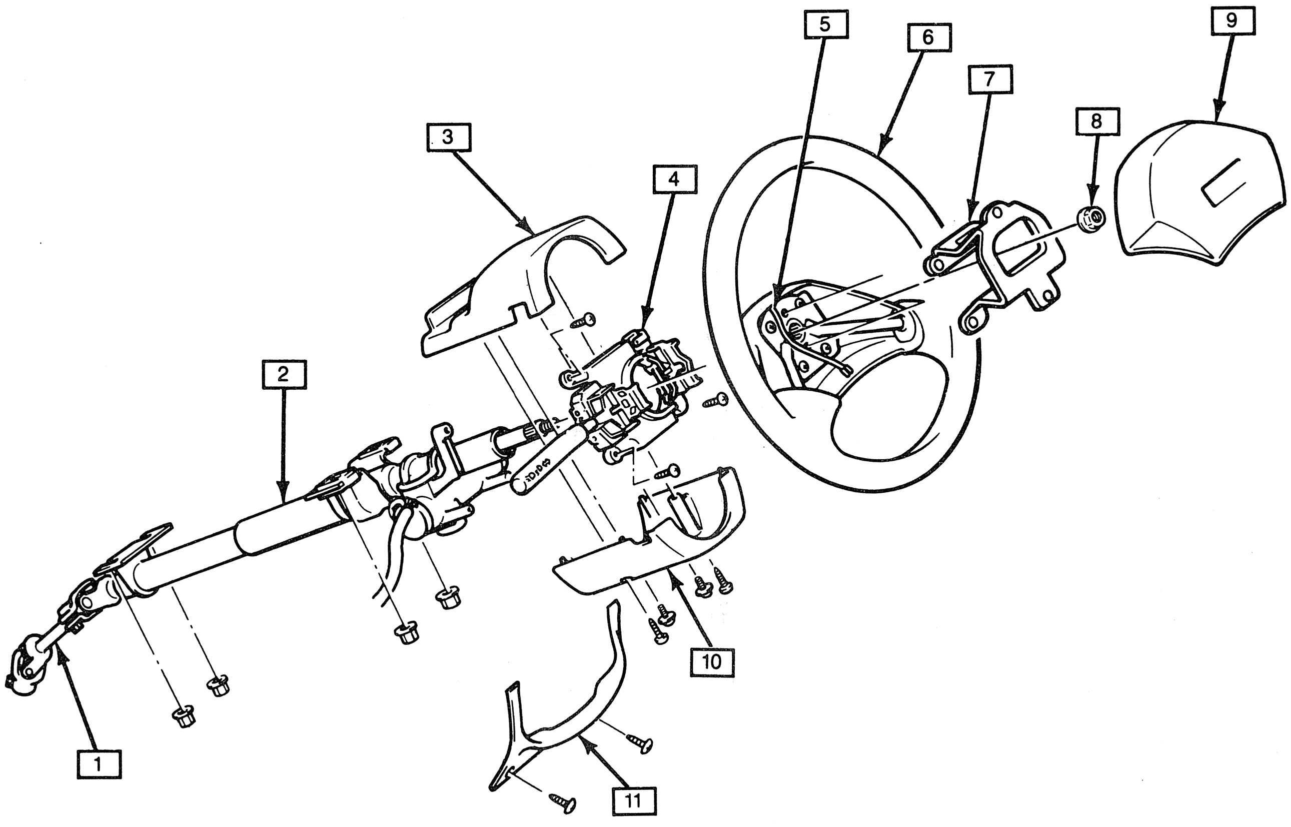
The ball and double tube type steering column includes three important features in addition to the steering function:

1. The column is energy absorbing, designed to compress in a front-end collision to minimize the possibility of an injury to the driver of the car.
2. The ignition switch and lock are mounted conveniently on this column.
3. With the column mounted lock, the ignition and steering operations can be locked to inhibit theft of the car.

The turn signal lever provides for control of headlight beams (Figure 1).

This column may be easily removed and installed. To insure the energy absorbing action, it is important that only the specified screws, bolts, and nuts be used as designated and that they are tightened to the specified torque (Figure 1).

When the column assembly is removed from the car, special care must be taken in handling it. Use of a steering wheel puller other than the one recommended in this manual or a sharp blow on the end of the steering shaft, leaning on the assembly, or dropping the assembly could shear the plastic shear pins which maintain column length (Figure 1).



1	STEERING SHAFT LOWER JOINT	7	STEERING WHEEL BUMPER
2	STEERING COLUMN ASSEMBLY	8	STEERING SHAFT NUT
3	STEERING COLUMN UPPER COVER	9	STEERING WHEEL PAD
4	TURN SIGNAL/DIMMER SWITCH	10	STEERING COLUMN LOWER COVER
5	GROUND WIRE	11	STEERING COLUMN UNDER COVER
6	STEERING WHEEL	12	STEERING LOCK ASSEMBLY

Figure 3F-1 - Steering Column-Explode

CONDITION	POSSIBLE CAUSE	CORRECTION
Horn inoperative	Blown 30A or 40A main fuse.	Replace.
	Open ground circuit.	Repair B wire.
	Defective horn relay.	Replace.
	Blown 15A fuse in fuseblock.	Replace.
	Defective horn switch.	Replace.
	Open circuit between main fuse(s) and horn relay.	Repair W/G and/or W/Y wire.
	Open circuit between horn relay and horn.	Repair W wire.
Horn always ON	Defective horn relay.	Replace.
	Defective horn switch.	Replace.
	Short to ground between horn relay and horn switch.	Repair BL/G and/or BL wire.
	Short to voltage between horn relay and horn.	Repair W and W/G wires.

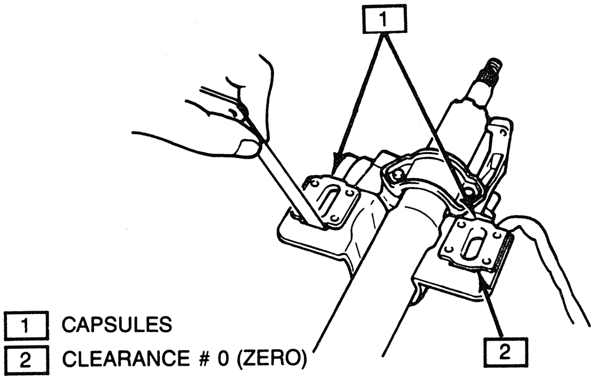
Figure 3F-2 - Horn Diagnosis

1. CHECKING STEERING COLUMN FOR ACCIDENT DAMAGE

NOTICE:
Cars involved in accidents resulting in body damage or where the steering column has been impacted may also have a damaged or misaligned steering column.

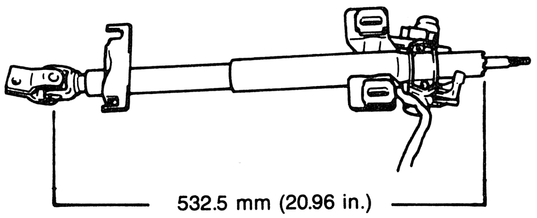
CHECKING PROCEDURE

1) Check capsules on steering column bracket; all should be contacting the bottom of the slots. If not, steering column assembly should be replaced. Use thickness gage for convenience.

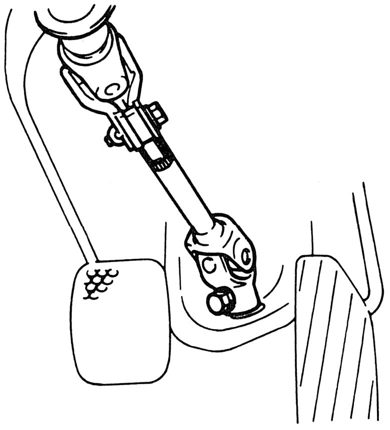


EACH CAPSULE SHOULD BE CONTACTING THE BOTTOM OF THE SLOT. IF NOT, REPLACE COLUMN ASSEMBLY.

2) Take measurement "A" as shown. If it is shorter than the specified length, replace column assembly with new one.



3) Check steering shaft joints and shaft for any damages such as crack, breakage, malfunction or excessive play. If anything is found faulty, replace as joint assembly.



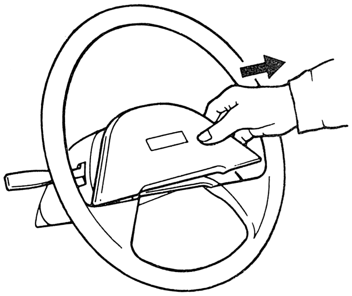
4) Check steering shaft for smooth rotation. If found defective, replace as column assembly.
5) Check steering shaft and column for bend, cracks or deformation. If found defective, replace.

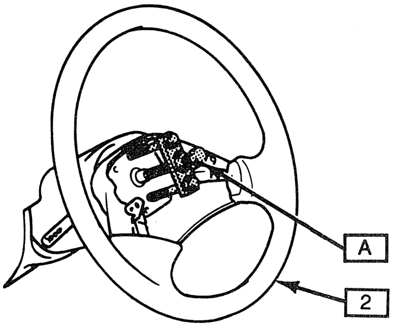
Figure 3F-3 - Checking Steering Column

2. REMOVE AND INSTALL STEERING WHEEL

REMOVAL

1) Disconnect negative battery cable.
2) Pull steering pad off and disconnect ground wire from inside of steering pad.
3) Remove steering wheel damper attaching screws and then steering wheel damper.
4) Remove steering shaft nut.
5) Scribe a line on the steering wheel and shaft to use as guide during reinstallation.
6) Remove steering wheel with special tool (A).





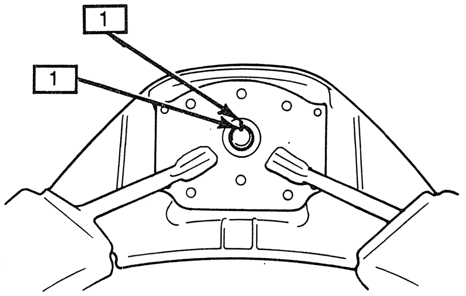
A STEERING WHEEL REMOVER J1859-03
1 SCRIBE ALIGNMENT LINE
2 STEERING WHEEL

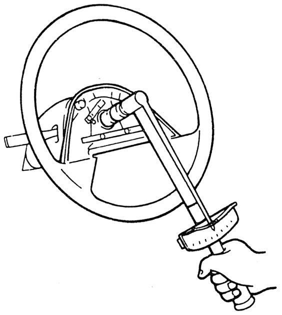
INSTALLATION

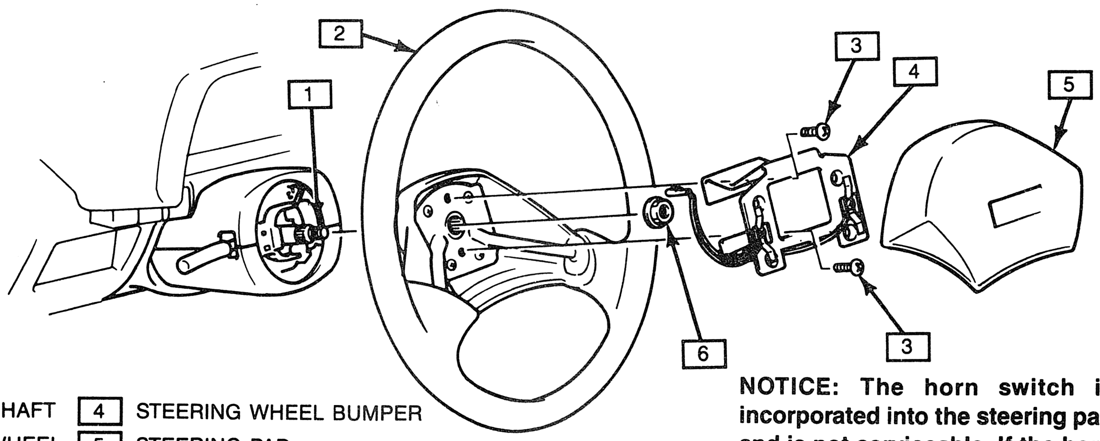
1) Install steering wheel onto shaft, using the alignment marks.
2) Install steering shaft nut and torque to 33 N•m (24.0 lb.ft.) as shown below.
3) Install steering wheel damper and damper attaching screws.

NOTICE: When installing steering wheel damper, be sure ground wire runs through center of damper and is not pinched underneath it.

4) Connect ground wire to inside of steering pad and press steering pad on.
5) Connect negative battery cable.







1 STEERING SHAFT
2 STEERING WHEEL
3 BUMPER SCREW
4 STEERING WHEEL BUMPER
5 STEERING PAD
6 STEERING SHAFT NUT TIGHTENING TORQUE 33 N•m (24.0 lb. ft.)

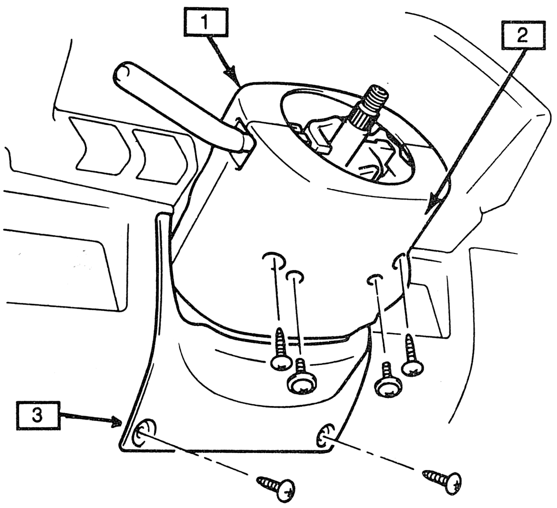
NOTICE: The horn switch is incorporated into the steering pad and is not serviceable. If the horn switch is found to be faulty, the steering pad must be replaced.

Figure 3F-4 - Steering Pad and Wheel

3. REMOVE AND INSTALL TURN SIGNAL/DIMMER SWITCH

REMOVAL

1) Disconnect negative battery cable.
2) Before removing this switch, remove steering wheel. Refer to STEERING WHEEL REMOVAL.
3) Remove column covers (under and lower).



1 UPPER COVER
2 LOWER COVER
3 UNDER COVER

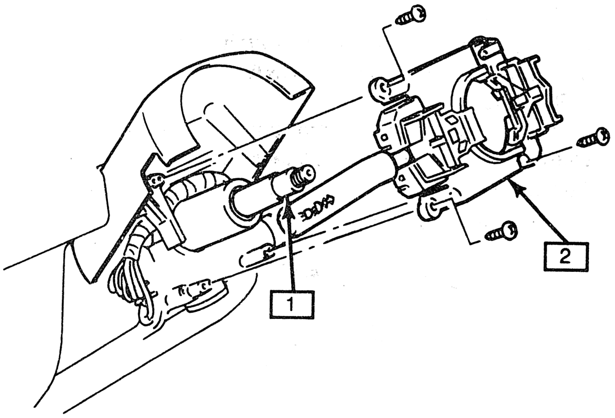
NOTE: MARKED WITH * ARE STANDARD SCREWS. ALL OTHERS ARE TAPPING SCREWS.

4) Disconnect lead wire from turn signal/dimmer switch electrical connector.
5) Loosen wire bands.
6) Remove three turn signal/dimmer switch attaching screws and the switch from the steering column shaft.

NOTICE: For diagnosis procedure of the turn signal/dimmer switch, see Section 8.

INSTALLATION

1) Install turn signal/dimmer switch and three attaching screws to the steering column shaft.
2) Connect lead wire to turn signal/dimmer switch electrical connector.
3) Tighten wire bands.
4) Install column lower and under covers.
5) Install steering wheel and steering pad. Refer to STEERING WHEEL INSTALLATION.



1 STEERING COLUMN SHAFT
2 TURN SIGNAL/DIMMER SWITCH

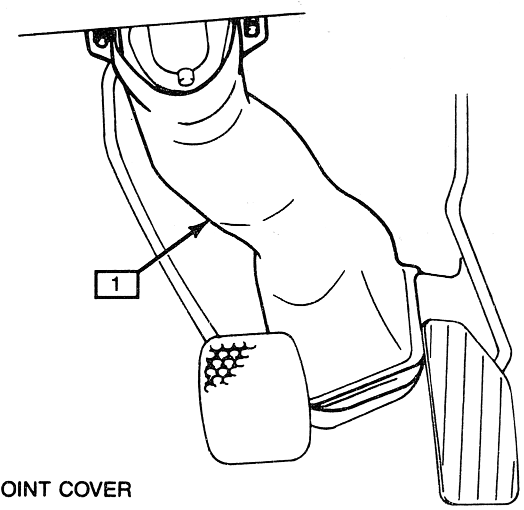
Figure 3F-5 - Turn Signal/Dimmer Switch

4. REMOVE AND INSTALL STEERING COLUMN

NOTICE:
Once the steering column is removed from the car, the column is extremely susceptible to damage. Dropping the column assembly on its end could collapse the steering shaft or loosen the plastic injections which maintain column length. Leaning on the column assembly could cause the jacket to bend or deform. Any of the above damage could impair the column's collapsible design. If it is necessary to remove the steering wheel, use standard wheel puller. Under no condition should the end of the shaft be hammered upon as hammering could loosen the plastic injections which maintain column length.

REMOVAL

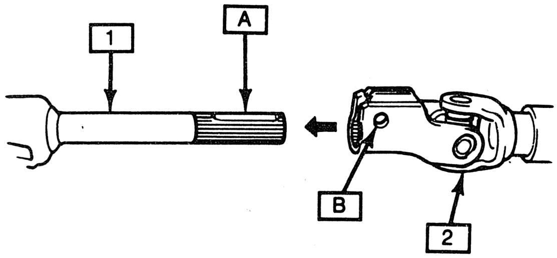
1) Disconnect negative battery cable.
2) Remove steering wheel. Refer to STEERING WHEEL REMOVAL.
3) Remove turn signal/dimmer switch. Refer to Steps 3 through 6 under TURN SIGNAL/DIMMER SWITCH REMOVAL.
4) Disconnect lead wires from ignition and ignition key warning switch electrical connector at junction/fusebox.
5) Pull off floor mat at the foot of steering shaft and remove steering joint cover.



1 JOINT COVER

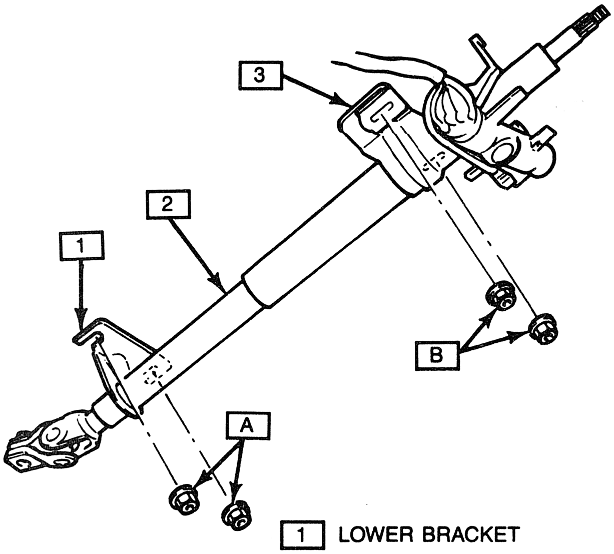
INSTALLATION

1) Align flat part "A" of lower joint shaft with bolt hole "B" of upper side joint as shown. Then insert upper side joint into lower joint shaft.



1 LOWER JOINT
2 UPPER JOINT

2) Install steering column assembly to lower and upper brackets. Torque steering column nuts to specifications as given below:
   - Tighten nuts (a) to 14 N•m (10 lb.ft.).
   - Tighten nuts (b) to 14 N•m (10 lb.ft.).

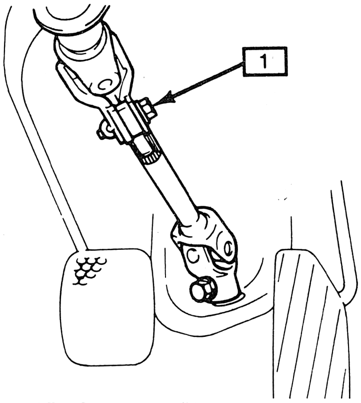


A 14 N•m (10 lb.ft.)
B 14 N•m (10 lb.ft.)

1 LOWER BRACKET
2 STEERING COLUMN
3 UPPER BRACKET

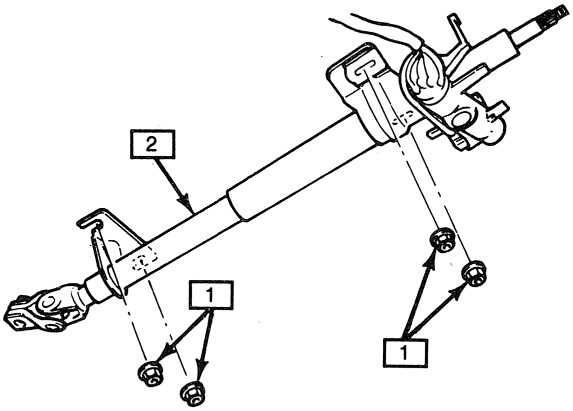
Figure 3F-6 - Steering Column A

6) Remove steering shaft joint upper side bolt.



1 STEERING SHAFT JOINT UPPER SIDE BOLT

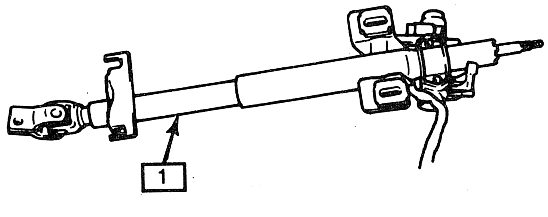
7) Remove steering column mount nuts.



1 STEERING COLUMN MOUNTING NUTS
2 STEERING COLUMN

8) Remove steering column assembly.

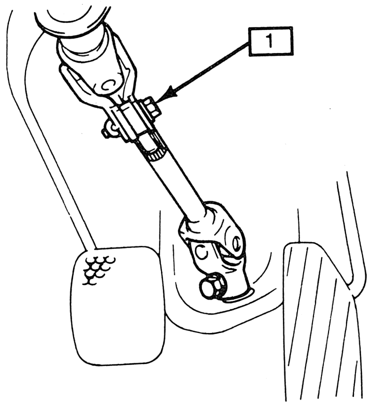
NOTICE: Do not disassemble steering column assembly into column and shaft. If steering column or shaft is found defective, replace as an assembly. See page 3F-6.



1 STEERING COLUMN ASSEMBLY

3) Install bolt to steering shaft upper joint and tighten it to specified torque.

NOTICE: After tightening column nuts, steering shaft joint upper side bolt should be tightened.



1 STEERING SHAFT JOINT UPPER SIDE BOLT
25 N•m (18 lb.ft.)

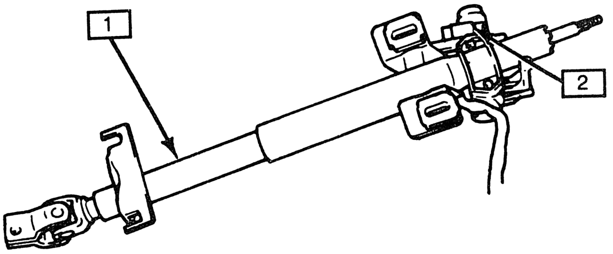
4) Install steering joint cover and put floor mat back as it was originally.
5) Connect lead wires from ignition switch and ignition key warning switch at connector.
6) Install turn signal/dimmer switch. Refer to steps 1 through 4 under TURN SIGNAL/DIMMER SWITCH INSTALLATION.
7) Install steering wheel and steering pad. Refer to STEERING WHEEL INSTALLATION.

Figue 3F-7 - Steering Column B

5. REMOVE AND INSTALL STEERING LOCK

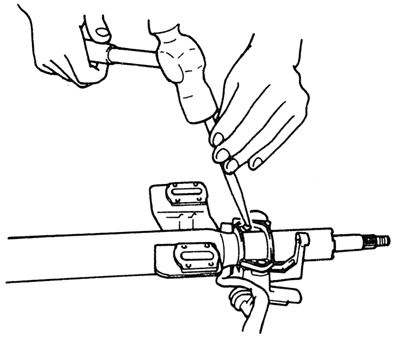
REMOVAL

1) Remove steering column. Refer to STEERING COLUMN REMOVAL.



1 STEERING COLUMN
2 IGNITION SWITCH ASSEMBLY

2) Using center punch as shown, loosen and remove steering lock mounting bolts. Use care not to damage aluminum part of steering lock body with center punch.

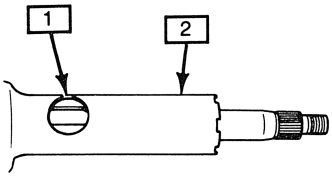


1 CENTER PUNCH (WITH SHARP POINT)
2 IGNITION SWITCH MOUNTING BOLTS

3) Turn ignition key to "ACC" or "ON" position and remove ignition switch assembly from steering column.

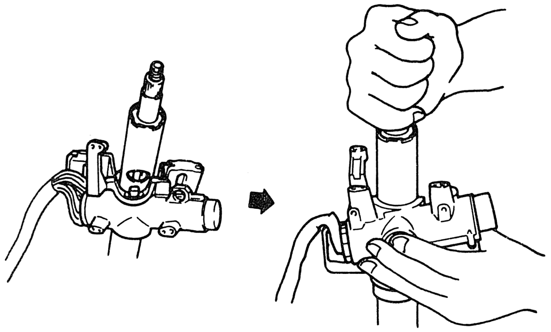
INSTALLATION

1) Position oblong hole of steering shaft in the center of hole in column.

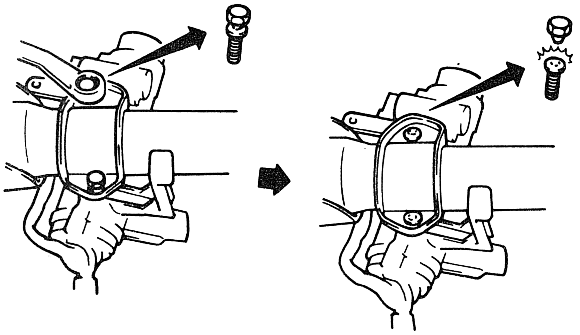


1 STEERING SHAFT
2 STEERING COLUMN

2) Turn ignition key to "ACC" or "ON" position and install ignition switch assembly onto column.
3) Now turn ignition key to "LOCK" position and pull it out.
4) Align hub on ignition switch assembly with oblong hole of steering shaft and rotate shaft to ensure that steering shaft is locked.



5) Tighten two new bolts until head of each bolt is broken off.



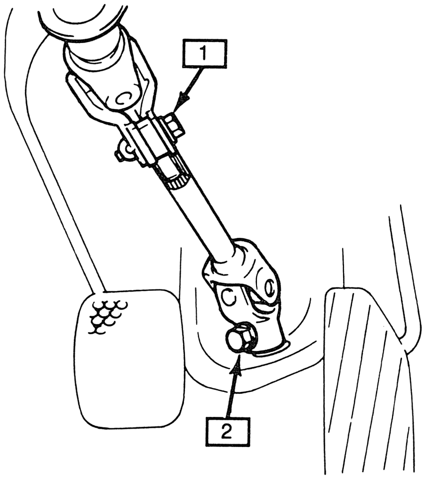
6) Turn ignition key to ''ACC' or ''ON'' position and check to be sure that steering shaft rotates smoothly. Also check for lock operation.
7) Install steering column. Refer to STEERING COLUMN INSTALLATION.

Figure 3F-8 - Ignition Switch

6. REMOVE AND INSTALL STEERING SHAFT LOWER JOINT

REMOVAL

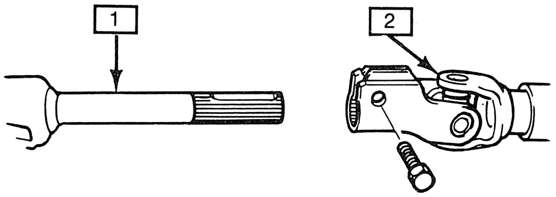
1) Set front wheels in the straightforward state and remove steering shaft joint cover.
2) Remove steering shaft joint bolts.



1 STEERING SHAFT JOINT UPPER SIDE BOLT
2 STEERING SHAFT JOINT LOWER SIDE BOLT

INSTALLATION

1) Align flat part of lower joint shaft with bolt hole of upper joint as shown. Then insert lower joint shaft into upper joint.



1 LOWER JOINT ASSEMBLY
2 UPPER JOINT ASSEMBLY

2) Be sure that front wheels and steering wheel are in straightforward state and insert lower joint into steering pinion shaft.
3) If steering column nuts were loosened in removal, torque lower bracket nuts to below specification first:

N·m	lb. ft.
14	10

And then torque upper bracket nuts to specification:

N·m	lb. ft.
14	10

4) Torque steering shaft joint bolts to specification:

N·m	lb. ft.
25	18

5) Install steering shaft joint cover.

6. REMOVE AND INSTALL HORN RELAY

REMOVAL

1) Disconnect negative battery cable.
2) Disconnect horn relay electrical connector.
3) Remove horn relay from mounting bracket, located near the front of the main fusebox.

INSTALLATION

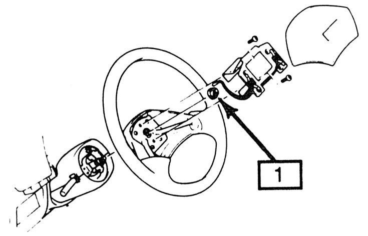
1) Horn relay to mounting bracket.
2) Connect horn relay electrical connector.
3) Connect negative battery cable.
4) Verify proper horn relay operation.

Figure 3F-9 - Steering Shaft Lower Joint

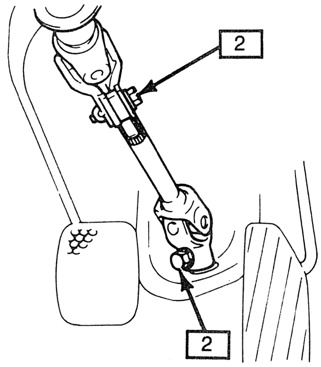
RECOMMENDED TORQUE SPECIFICATIONS

Fastening Parts	Tightening Torque	
	N•m	lb.ft.
1. Steering shaft nut	33	24
2. Steering shaft joint bolts	25	18
3. Steering column nuts (lower side)	14	10
4. Steering column nuts (upper side)	14	10

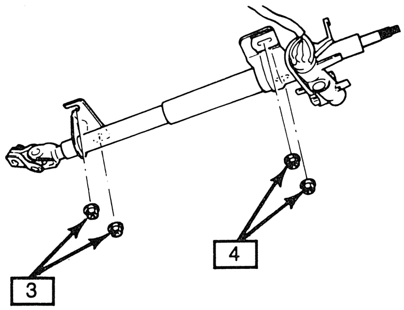
1.



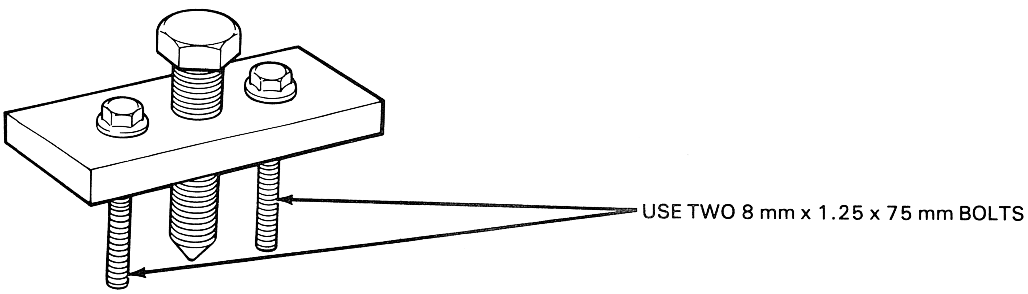
2.



3.



SPECIAL TOOL



J 1859-03
Steering wheel remover

Figure 3F-10 - Torque Specifications and Special Tools

SECTION 4D

DRIVE AXLE

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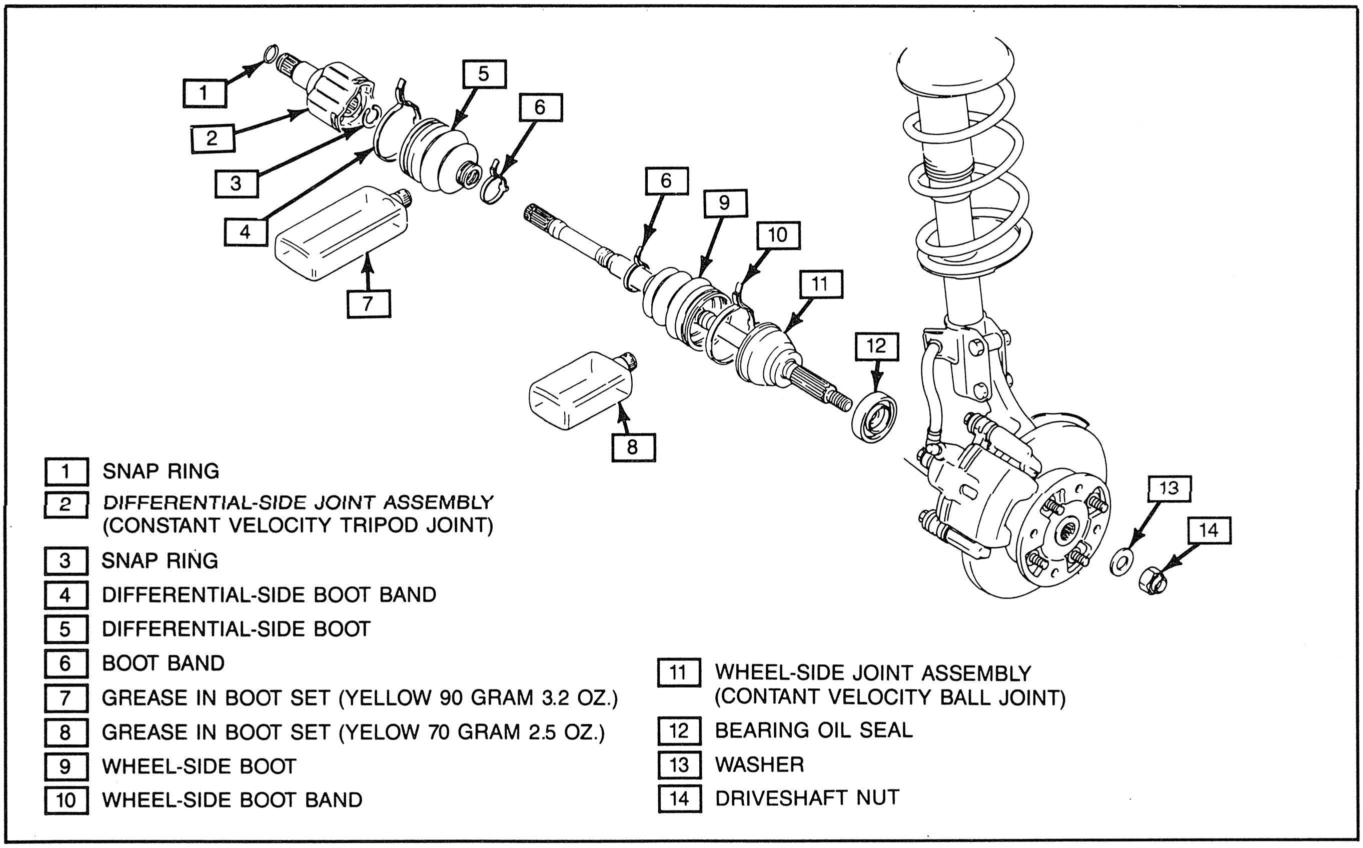
GENERAL DESCRIPTION

A constant velocity ball joint is used on the wheel side of the drive axle and a constant velocity tripod joint on the differential side. The drive axle can slide thru the tripod joint in the extension/contraction direction of the axle.



1 SNAP RING
2 *DIFFERENTIAL-SIDE JOINT ASSEMBLY (CONSTANT VELOCITY TRIPOD JOINT)*
3 SNAP RING
4 DIFFERENTIAL-SIDE BOOT BAND
5 DIFFERENTIAL-SIDE BOOT
6 BOOT BAND
7 GREASE IN BOOT SET (YELLOW 90 GRAM 3.2 OZ.)
8 GREASE IN BOOT SET (YELOW 70 GRAM 2.5 OZ.)
9 WHEEL-SIDE BOOT
10 WHEEL-SIDE BOOT BAND
11 WHEEL-SIDE JOINT ASSEMBLY (CONTANT VELOCITY BALL JOINT)
12 BEARING OIL SEAL
13 WASHER
14 DRIVESHAFT NUT

Figure 4D-1 - Drive Axle

ON CAR SERVICE

REMOVAL

1. Remove wheel center cap.
2. Remove caulking, driveshaft nut (14) and washer (13).

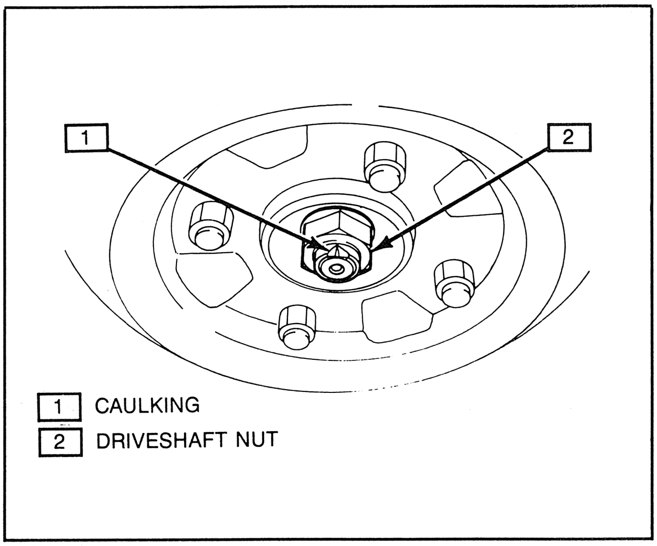


Figure 4D-2 - Split Pin and Drive Shaft Nut

3. Loosen wheel nuts.
4. Raise the vehicle and support it on jack stands.
5. Remove front wheel.
6. Drain transaxle oil.
7. To detach the snap ring (1) fitted on the spline of differential-side joint (inboard joint) from differential-side gear, pry the inboard joint by using a tire lever or large screwdriver (Figure 4D-3).
8. Remove ball-stud bolt and nut; then separate suspension arm from knuckle (Figure 4D-4).
9. To remove the drive axle assembly, detach inboard joint from differential-side gear and then wheel-side joint (outboard joint) from steering knuckle.

NOTICE: To prevent the breakage of the boots (wheel side and differential side), be careful not to bring them into contact with other parts when removing the drive axle assembly.

DISASSEMBLY

1. Remove tripod joint boot band (4).
2. Remove tripod joint housing (2) (Figure 4D-5).
3. Remove grease from the shaft and take off snap ring (3) using special tool, then pull out tripod-joint spider (15); finally, pull spider from shaft.
4. Remove boot band (6), then pull out differential-side boot from shaft (Figure 4D-5).
5. Release boot bands of wheel-side joint boot (6 and 10), then pull boot from shaft.

NOTICE: Do not disassemble the wheel-side joint (outboard joint). If any malcondition is found in the joint, replace it as an assembly.
Do not disassemble the spider of differential-side joint. If any malcondition is found in the spider, replace the differential-side joint assembly.

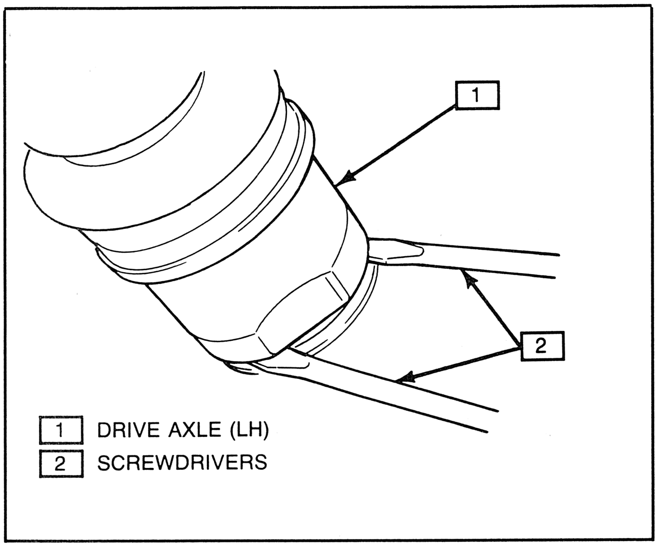


Figure 4D-3 - Detaching Snap Ring from Differential Side Gear

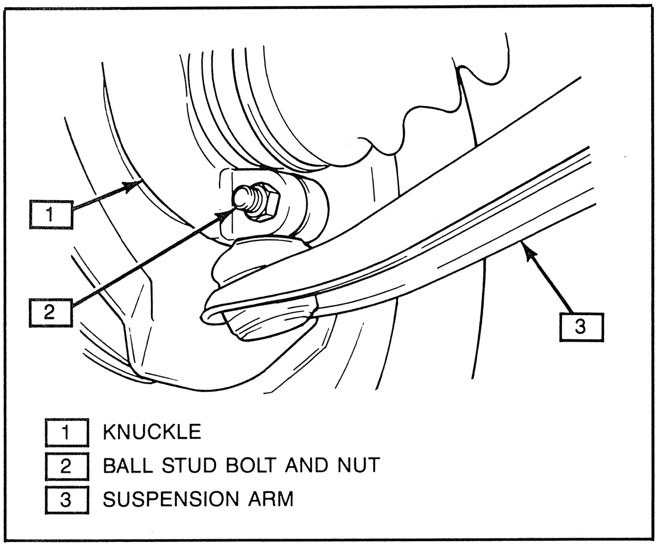


Figure 4D-4 - Detaching Ball Stud from Steering Knuckle

INSPECTION

- Check the boots for tears or deterioration. Replace them as necessary.
- Check the snap rings and boot bands for breakage or deformation. Replace as necessary.

CLEANING

- Wash the disassembled parts (except the boots and the spider of differential side joint) in degreaser. After washing, dry the parts completely with compressed air.
- Clean the boots with a rag. DO NOT wash the boots in degreaser.
  Washing in degreaser causes deterioration of boot.
- Clean the spider of the differential side joint with a clean towel. To prevent the needle bearings of the spider from being degreased, DO NOT wash the spider in degreaser.

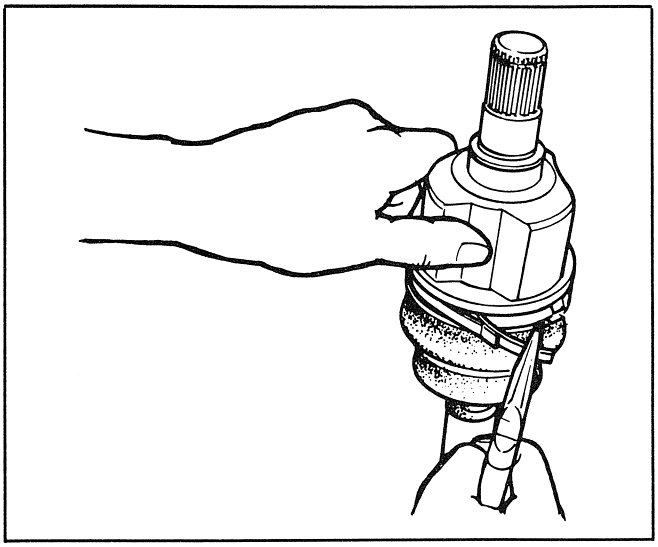


Figure 4D-5 - Boot Band

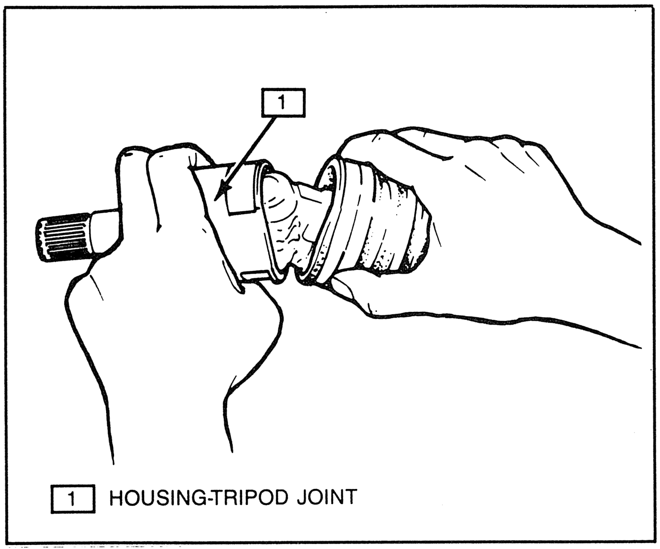


Figure 4D-6 - Removing Housing of Differential Side Joint

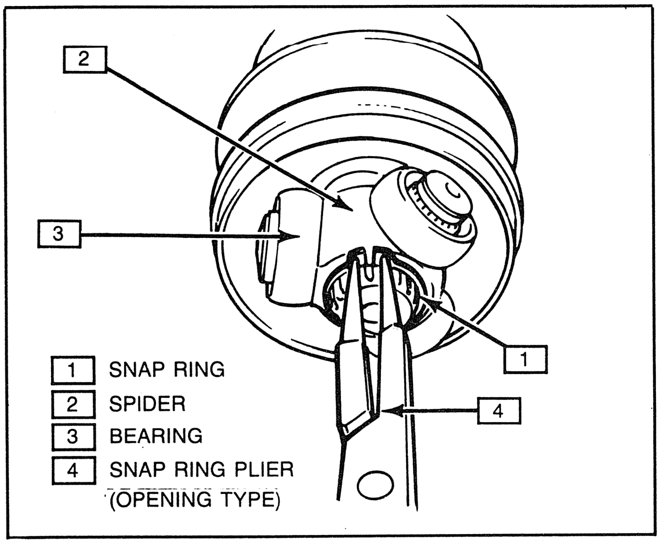


Figure 4D-7 - Snap Ring and Spider

ASSEMBLY

Thoroughly inspect parts for wear before reassembly — replace any excessively worn parts. Make sure that the wheel-side joint assembly and tripod joint housing are washed and air dried, and that the boots are cleaned with a cloth, if they are to be reused.

1. Liberally apply the joint grease to the wheel side joint. Use the block joint grease in the tube included in the wheel-side boot set or wheel-side joint assembly.
2. Fit the wheel-side boot on the shaft. Fill the inside of boot with joint grease, approx. 80 grams, then fix the boot bands. (Figure 4D-8).
3. Fit the differential-side boot on the shaft.
4. Liberally apply the joint grease to the differential-side joint. Use the yellow joint grease in the tube included in the differential-side boot set or the differential-side joint assembly.
5. Install the spider of the differential-side joint on the shaft,facing its chamfered side to the wheel side joint. (Figure 4D-8).
6. After installing the spider, fit the snap ring in the groove of the shaft. (Figure 4D-7).
7. Fill the inside of differential-side boot with the joint grease, approx. 130 gram, then install the housing Fix the boot to the housing with a boot band. (Figure 4D-8).
8. Check the boots for distortion or dents. If distorted or dented, correct it.

INSTALLATION

Reverse the removal procedure.

Clean the front-wheel bearing seal and then apply grease to the seal.

Check the seal for breakage or deterioration. Replace it if necessary.

Apply sealant to drain plug for manual transaxle.

- Install the wheel-side joint to the steering knuckle and then the differential-side joint to the differential-side gear. Push the differential-side joint by hand until it is positioned by the snap ring fitted to its spline. (Figure 4D-4).

NOTICE: To prevent the breakage of the boots (wheel side and differential side), be careful not to bring them into contact with other parts, when installing the drive axle assembly.

Do not pull the housing of the differential side joint. If the housing is pulled, it may be detached from the drive axle.

- Tighten each bolt and nut to the specified torque.
- After tightening the drive shaft nut, install the split pin to the shaft.
- Refill the transaxle.

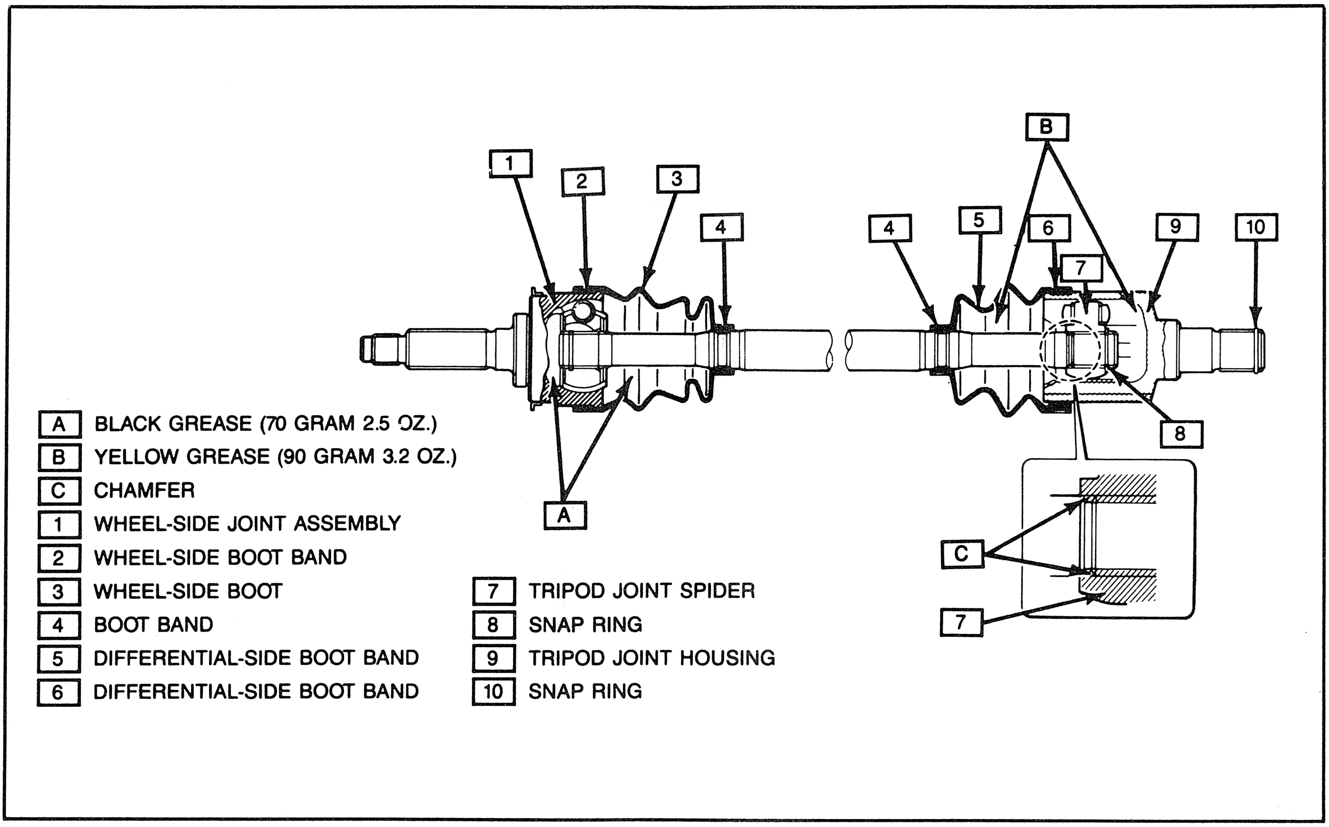

1
2
3
4
4
5
6
7
9
10
B
8
A
C
7
A BLACK GREASE (70 GRAM 2.5 OZ.)
B YELLOW GREASE (90 GRAM 3.2 OZ.)
C CHAMFER
1 WHEEL-SIDE JOINT ASSEMBLY
2 WHEEL-SIDE BOOT BAND
3 WHEEL-SIDE BOOT
4 BOOT BAND
5 DIFFERENTIAL-SIDE BOOT BAND
6 DIFFERENTIAL-SIDE BOOT BAND
7 TRIPOD JOINT SPIDER
8 SNAP RING
9 TRIPOD JOINT HOUSING
10 SNAP RING

Figure 4D-8 · Assembling Drive Axle

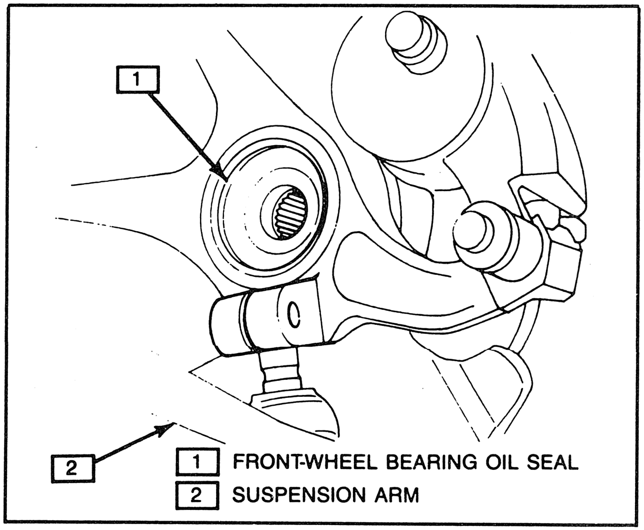

1
2
1 FRONT-WHEEL BEARING OIL SEAL
2 SUSPENSION ARM

Figure 4D-9 - Front Wheel Bearing Seal

BOLT OR NUT	TIGHTENING TORQUE
STABILIZER BAR MOUNT BRACKET BOLTS	30 – 55 N·m 3.0 – 5.5 kg-m 22.0 – 39.5 lb.-ft.
BALL JOINT STUD BOLT AND ITS LOCK NUT	50 – 70 N·m 5.0 – 7.0 kg-m 36.5 – 50.5 lb.-ft.
DRIVE SHAFT NUT	150 – 270 N·m 15.0 – 27.0 kg-m 108.5 – 195.0 lb.-ft.
WHEEL NUTS	40 – 70 N·m 4.0 – 7.0 kg-m 29.0 – 50.5 lb.-ft.

Figure 4D-10 - Specifications

TORQUE SPECIFICATIONS

Oil Drain Plug Man. Trans.	28 N·m (21 lb.ft.)
Auto. Trans	21 N·m (15 lb.ft.)
Oil Filter & Level Plug Man. Trans.	45 N·m (33 lb.ft.)
Ball Joint Stud Nut & Bolt	60 N·m (44 lb.ft.)
Driveshaft Nut	175 N·m (129 lb.ft.)

SECTION 5

BRAKES

NOTICE: All brake fasteners are important attaching parts in that they could affect the performance of vital parts and systems, and/or could result in major repair expense. They must be replaced with one of same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of all parts. There is to be no welding as it may result in extensive damage and weakening of the metal.

CAUTION: When servicing wheel brake parts, do not create dust by grinding, sanding brake linings, or by cleaning wheel brake parts with a dry brush or with compressed air. Many wheel brake parts contain asbestos fibers which can become airborn if dust is created during servicing. Breathing dust containing asbestos fibers may cause serious bodily harm. A water dampened cloth or water based solution should be used to remove any dust on parts. Equipment is commercially available to perform this washing function. These wet methods will prevent asbestos fibers from becoming airborn.

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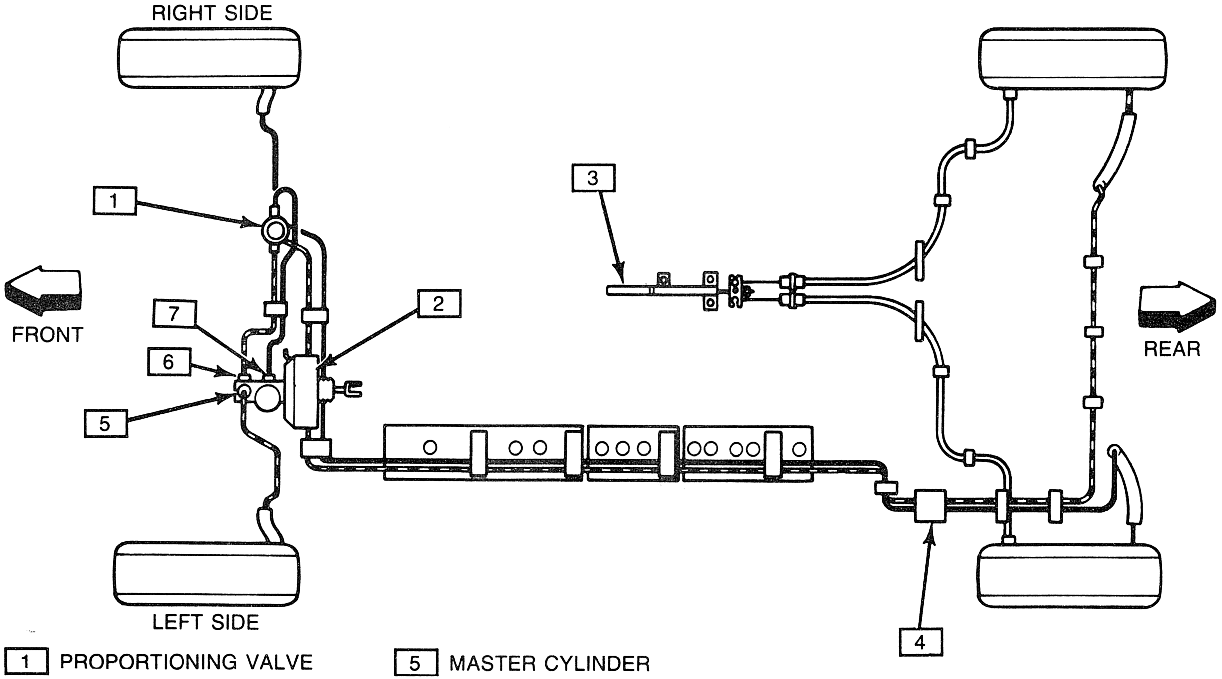
GENERAL DESCRIPTION

When the brake pedal is depressed, hydraulic pressure is developed in the master cylinder to actuate pistons (two in front and four in rear).
The master cylinder is a tandem master cylinder. Two brake pipes are connected to the master cylinder and they make two independent circuits. One connects the front right & rear left brakes and the other connects the front left & rear right brakes.
The proportioning valve is included in these circuits between the master cylinder and rear wheels.
In this brake system, the disc brake type is used for the front wheel brake and a drum brake type (leading/trailing shoes) for the rear wheel brake.
The parking brake system is mechanical. It applies brake force to only rear wheels by means of the cable and mechanical linkage system. The same brake shoes are used for both parking and rear brakes.



1 PROPORTIONING VALVE	5 MASTER CYLINDER
2 BRAKE BOOSTER	6 SECONDARY SIDE
3 PARKING BRAKE LEVER	7 PRIMARY SIDE
4 4 WAY JOINT	

LC0001-5-M-RS

Figure 5-1 General Description

DISC BRAKE CALIPER ASSEMBLY

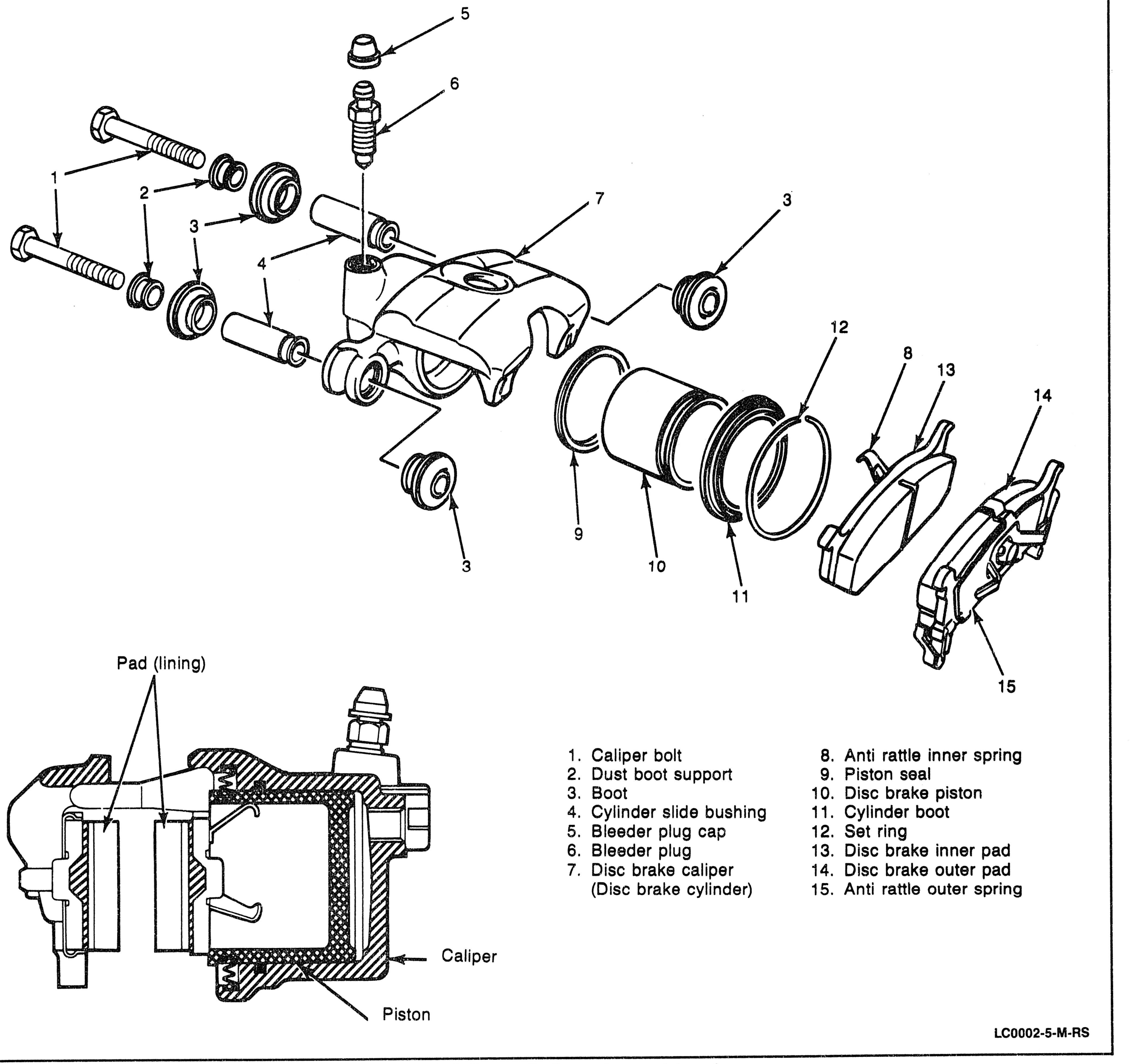
GENERAL DESCRIPTION

This caliper has a single 48.0 mm bore and is mounted to the knuckle with two mounting bolts. Hydraulic force, created by applying force to the brake pedal, is converted by the caliper to friction. The hydraulic force acts equally against the piston and the bottom of the caliper bore to move the piston outward and to move the caliper inward resulting in a clamping action on the disc. This clamping action forces the pads against the disc, creating friction to stop the vehicle.

For details, refer to OPERATION in the next page.

NOTICE:

Lubricate parts as specified. Do not use lubricated shop air on brake parts as damage to rubber components may result. If any component is removed or line disconnected, bleed the brake system. Replace pads in axle sets only. The torque values specified are for dry, unlubricated fasteners.



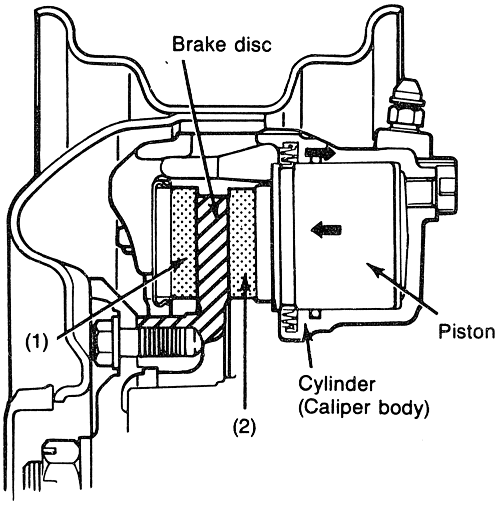
1. Caliper bolt
2. Dust boot support
3. Boot
4. Cylinder slide bushing
5. Bleeder plug cap
6. Bleeder plug
7. Disc brake caliper (Disc brake cylinder)
8. Anti rattle inner spring
9. Piston seal
10. Disc brake piston
11. Cylinder boot
12. Set ring
13. Disc brake inner pad
14. Disc brake outer pad
15. Anti rattle outer spring

Figure 5-2 Front Caliper Assembly - A

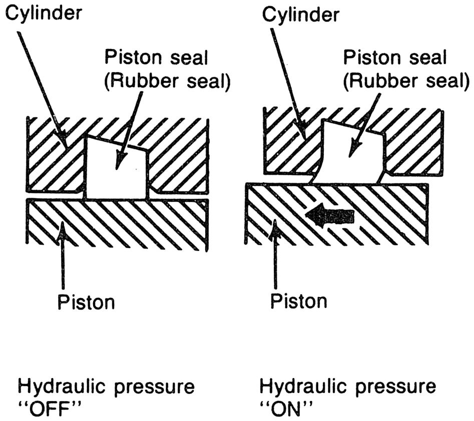
[Caliper OPERATION]

Single piston floating caliper type

The single piston floating caliper type brake is employed in this model. One cylinder and one piston are used for this type. (The cylinder is constructed as a monoblock with the caliper.) Fluid pressure generated in the cylinder causes the pad (2) on the piston side to press against the disc. At the same time, the floating type caliper body is moved to the right by the cylinder pressure, as shown in the figure below, which pulls pad (1) against the disc and brakes the wheel.



The disc brake has no servo assistance as in drum braking, and it is necessary to increase the working pressure of the piston and pad. For this purpose, the caliper cylinder has a large bore. Only a little change in clearance between the disc and pad has therefore a large influence on the brake pedal stroke. It is necessary to have the clearance adjusted to the minimum at all times, by means of the piston (rubber) seal.



Clearance correction

When fluid pressure is applied to the piston, the piston moves forward. The rubber seal, which exerts considerable pressure against the piston, moves with the cylinder. However, as a part of the rubber seal has been fixed into a groove in the cylinder, the shape of the rubber seal is distorted toward the internal end of the cylinder, as shown in above Figure. When pressure is taken off of the brake pedal and fluid pressure is released from the piston, a restoring force is generated at the seal and pushes the piston back. As the pads wear away and the clearance between the disc and pads becomes larger, the piston moves a larger distance. The seal then could change in shape further, but since the end of the seal is fixed into the groove in the cylinder, the distortion is limited to the same amount as previously described. The piston moves further to cover the distance of clearance. The piston returns by the same distance and the rubber seal recovers its shape as described above and thus the clearance between the disc and pads is maintained in adjustment.

Figure 5-3 Front Caliper Assembly - B

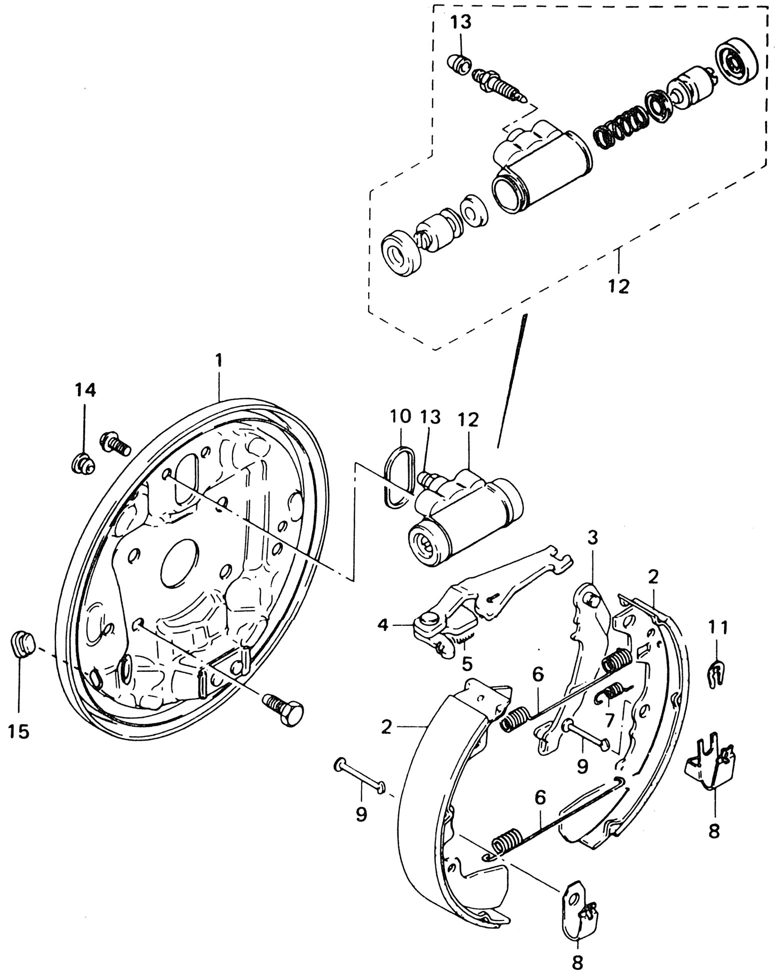
DRUM BRAKE ASSEMBLY

GENERAL DESCRIPTION

The drum brake assembly has a self shoe clearance adjusting system so that drum-to-shoe clearance is maintained appropriate at all times. For details, refer to OPERATION in the next page.

NOTICE:

Replace all components included in repair kits used to service this drum brake. Lubricate parts as specified.



1. Brake back plate
2. Brake shoe
3. Parking brake shoe lever
4. Brake strut
5. Quadrant spring
6. Shoe return spring
7. Antirattle spring
8. Shoe hold down spring
9. Shoe hold down pin
10. Packing
11. Parking level retainer
12. Wheel cylinder
13. Bleeder plug cap
14. Rubber plug
15. Rubber plug

LC0003-5-M-RS

Figure 5-4 Rear Brake Drum Assembly - A

[Rear brake OPERATION]

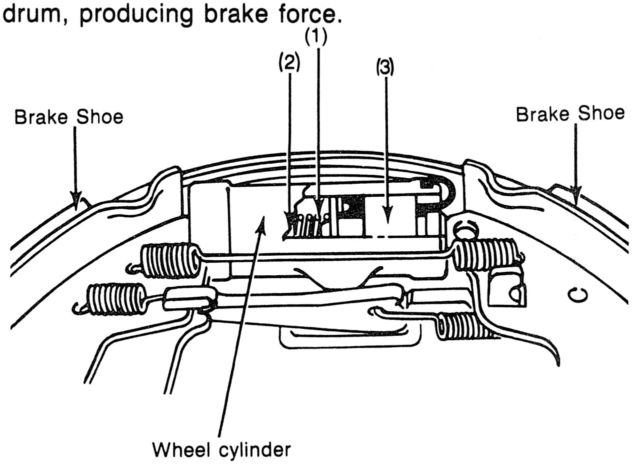
With the general drum brake type, when the brake pedal is depressed, two pistons in the wheel cylinder force the brake shoes outward, restraining the turn of the drum. The more the brake shoes get worn, the longer the distance the pistons must move. As a result, the brake pedal travel (pedal-to-wall clearance) increases. Then the shoe clearance must be adjusted by the shoe adjusting screws. Thus, periodical adjustment is required for the drum brake type in general.

This rear brake is provided with a self-adjusting system which automatically adjusts the shoe-to-drum clearance caused by brake shoe wear.

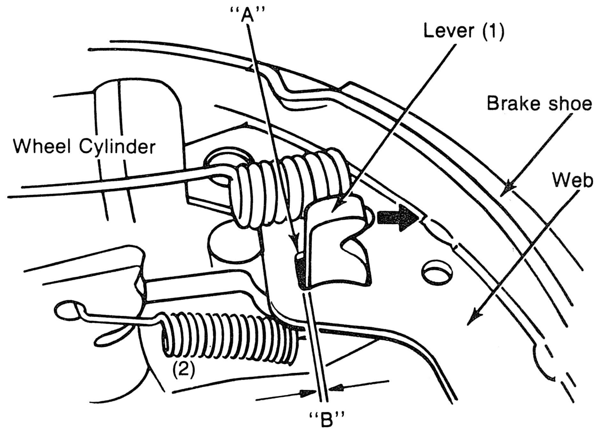
Clearance correction

In each rear wheel cylinder, pistons, piston cups and a piston spring (1) are installed. When the brake pedal is depressed, fluid pressure is applied to the inside of the chamber on the piston (2), (3).

Being actuated by this pressure, the piston (2) moves to the left (piston (3) moves to the right) in the following figure and presses the brake shoe against the brake drum, producing brake force.



At this time, the distance the brake shoe moves is "B", that is, the distance that "A" (the end of the long hole made in the brake shoes web) moves until it contacts the lever (1) which is fitted in the long hole.



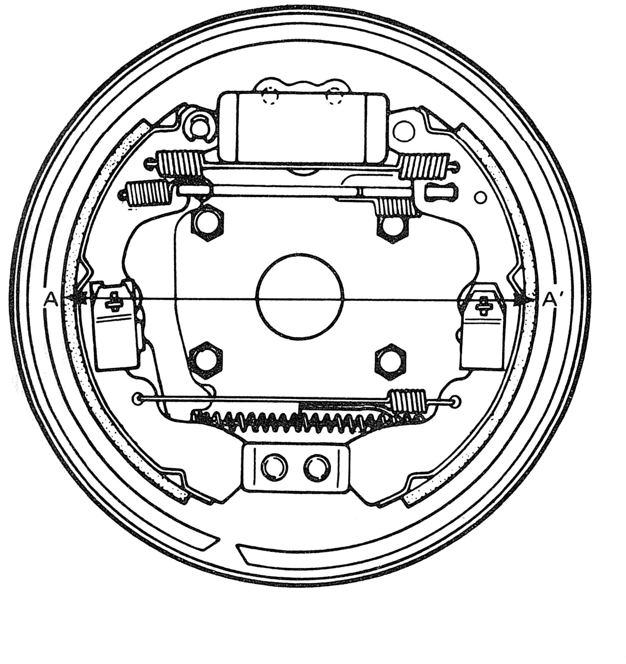
When the brake pedal is depressed, the piston and brake shoe move toward the brake drum side by the previously mentioned distance "B" and "A" until the brake shoe web contacts the lever (1). As the brake shoe gets worn and the brake shoe clearance becomes larger, the force applied to the lever (1) at the time of such a contact becomes larger. When it exceeds 10 - 12 kg (22 - 26 lbs), the "A" of the brake shoe web moves the lever (1) as much as the amount of the brake shoe lining wear toward the direction as shown with an arrow in the figure. Thus, the shoe is forced against the drum and the brake force is produced.

The distance the lever (1) moves corresponds to the amount of wear. In accordance with the lever (1) movement, the fan-shaped ratchet (2) also moves, as they are assembled as a unit. The lever (1) and ratchet (2) remain in the positions as they moved until the shoe-to-drum clearance becomes even larger.

When the brake pedal is released, the brake shoe is allowed to move back by the amount of clearance "B" by means of the return spring. In this way, the brake shoe-to-drum clearance is automatically adjusted constant every time the brake pedal is depressed.

The brake shoe-to-drum clearance "B" corresponds to 0.36 - 0.54 mm (0.014 - 0.021 in.) in terms of the brake drum diameter A – A′. And the amount adjusted by one notch of the ratchet corresponds to 0.18 mm (0.007 in.) in terms of the brake drum diameter A – A′.

The spring provided in the wheel cylinder prevents the piston from moving back more than the specified brake shoe-to-drum clearance.



LC0004-5-M-RS

Figure 5-5 Rear Brake Drum Assembly - B

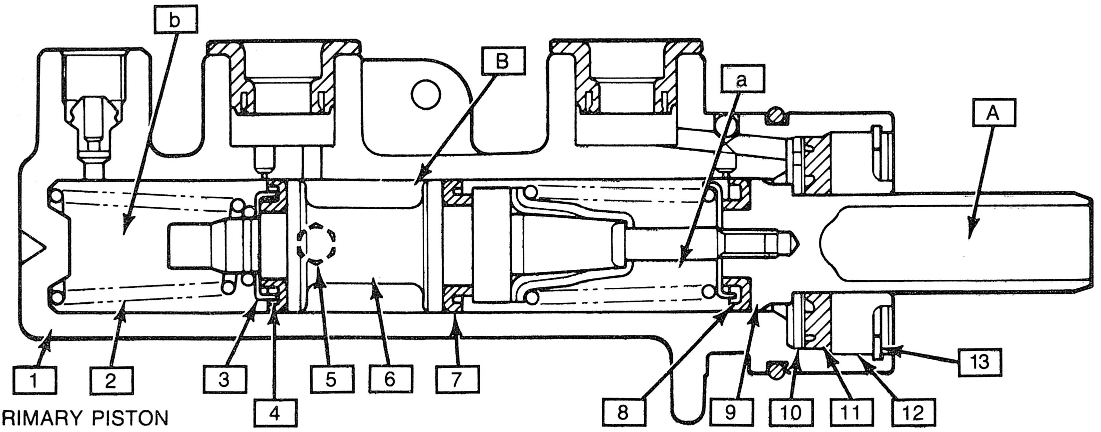
GENERAL DESCRIPTION

The master cylinder has two pistons and three piston cups. Its hydraulic pressure is produced in the primary ("a" in the below figure) and secondary ("b") chambers. The hydraulic pressure produced in the primary chamber ("a") acts on the right front wheel brake and left rear wheel brake.

Also, the hydraulic pressure produced in the secondary chamber ("b") acts on the left front wheel brake and right rear wheel brake.

NOTE:

Replace all components included in repair kits to service this master cylinder. Lubricate rubber parts with clean, fresh brake fluid to ease assembly. Do not use lubricated shop air on brake parts as damage to rubber components may result. If any hydraulic component is removed or brake line disconnected, bleed the brake system. The torque values specified are for dry, unlubricated fasteners.



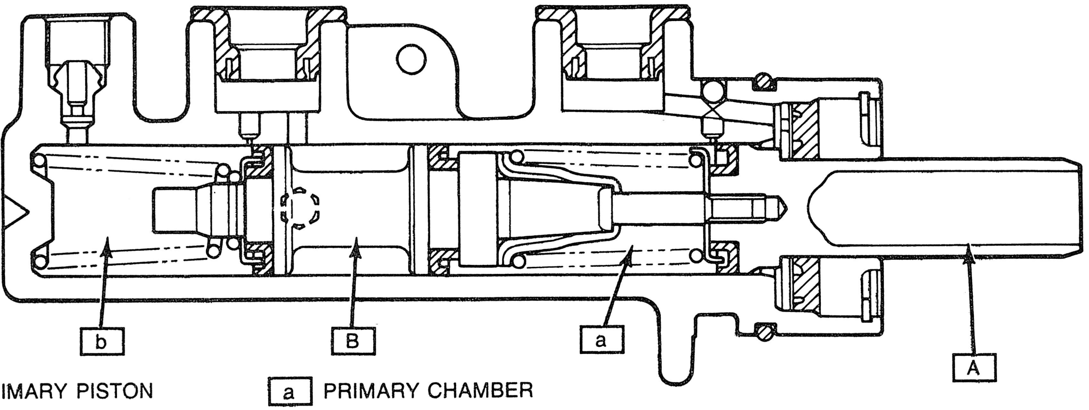
A PRIMARY PISTON
B SECONDARY PISTON
a PRIMARY CHAMBER
b SECONDARY CHAMBER
1 MASTER CYLINDER BODY
2 SECONDARY RETURN PISTON SPRING
3 RETURN SPRING SECONDARY SEAT
4 PISTON CUP
5 SECONDARY PISTON STOPPER BOLT
6 SECONDARY PISTON
7 SECONDARY PISTON PRESSURE CUP
8 PISTON CUP
9 PRIMARY PISTON
10 PLATE
11 CYLINDER CUP
12 PISTON STOPPER
13 PISTON STOPPER SNAP RING

Master Cylinder OPERATION

Normal operation

Depressing the brake pedal forces the primary piston "A" to move to the left in the below figure and consequently the hydraulic pressure is produced in the chamber "a".

With this pressure and the return spring force, the secondary piston "B" is also pushed to the left and thus the hydraulic pressure is produced in the chamber "b".



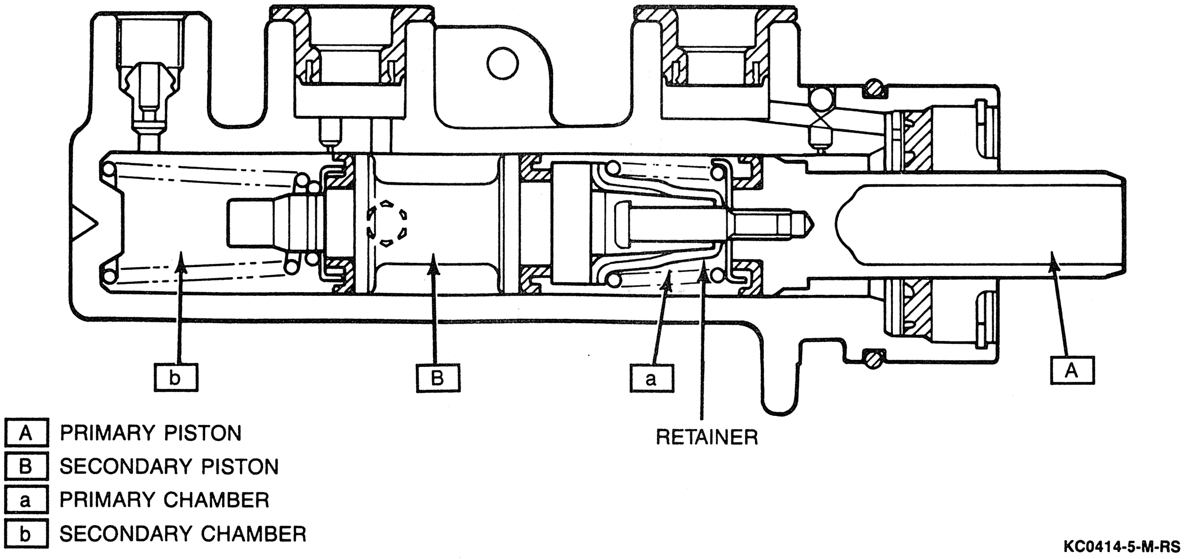
A PRIMARY PISTON
B SECONDARY PISTON
a PRIMARY CHAMBER
b SECONDARY CHAMBER

LC0005-5-M-RS

Figure 5-6 Master Cylinder Assembly - A

One-circuit operation (Primary chamber "a" circuit failure)

Depressing the brake pedal forces the primary piston "A" to move as described previously, but since the brake circuit connected to the chamber "a" cannot hold the pressure, no pressure is produced in the fluid immediately ahead of the piston "A". The piston "A" keeps moving while compressing the spring and when it reaches the retainer, the piston "B" is pushed and begins to move. This causes the pressure to rise in the chamber "b" and the pressure acts on the left front wheel brake and right rear wheel brake.


b
B
a
A
RETAINER
A PRIMARY PISTON
B SECONDARY PISTON
a PRIMARY CHAMBER
b SECONDARY CHAMBER
KC0414-5-M-RS

One-circuit operation (Secondary chamber "b" circuit failure)

In this case, the leftward movement of the piston "A" has little effect on causing the fluid pressure to rise in the chamber "a" in the beginning, because the initial rise of the fluid pressure causes the piston "B" to promptly yield and move to the left. However, when the forward end of the piston "B" comes to the head of the cylinder and stops there, the leftward movement of the piston "A" becomes effective. Thus the fluid pressure is produced in the chamber "a" and it acts on the right front wheel brake and left rear wheel brake. The below figure shows secondary piston "B" at halt.

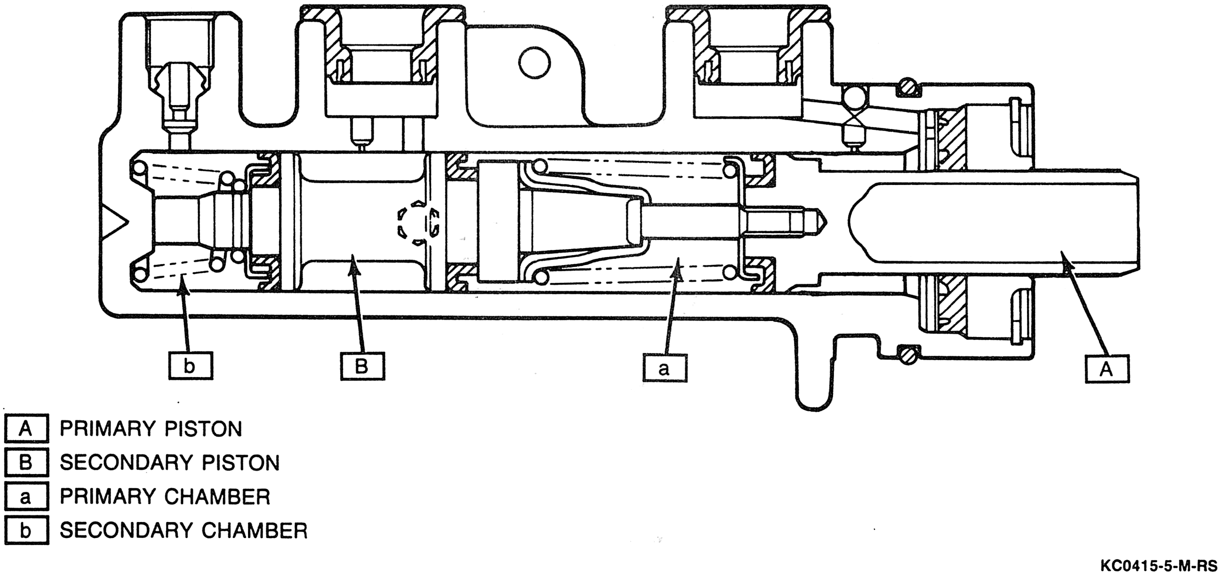

b
B
a
A
A PRIMARY PISTON
B SECONDARY PISTON
a PRIMARY CHAMBER
b SECONDARY CHAMBER
KC0415-5-M-RS

Figure 5-7 Master Cylinder Assembly - B

BOOSTER ASSEMBLY

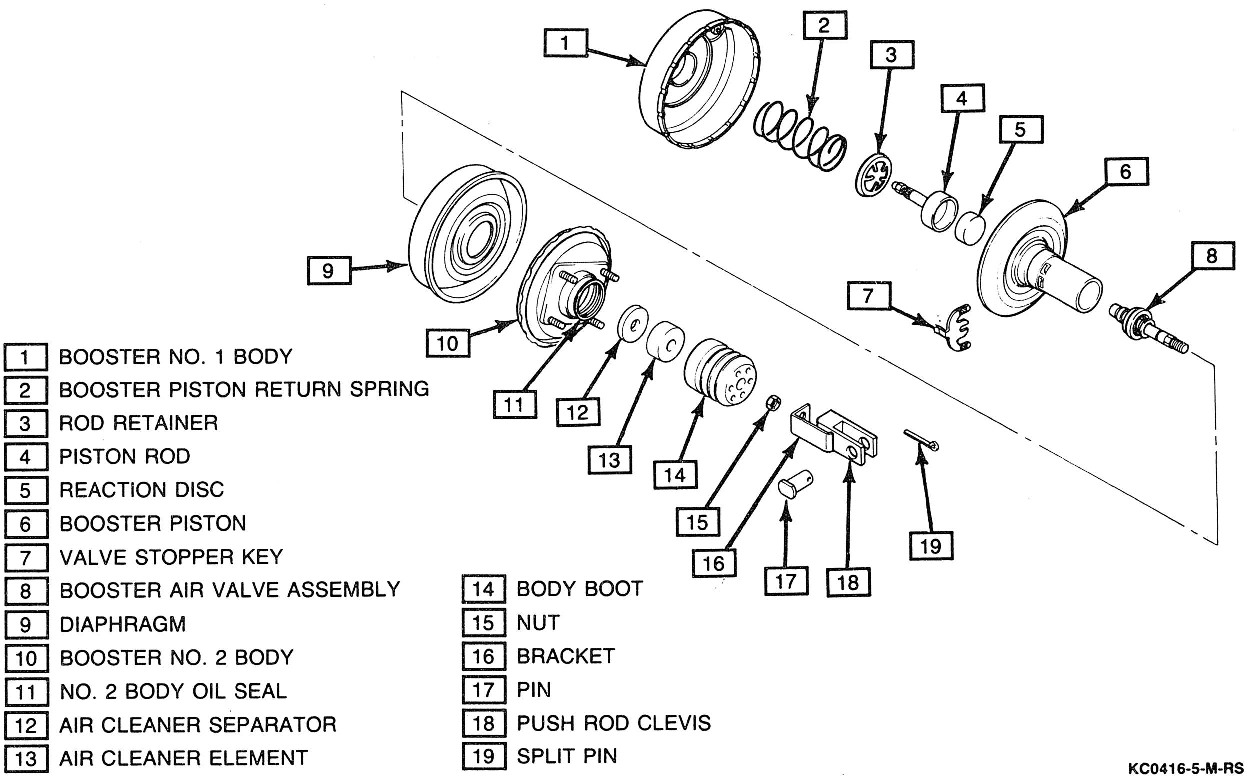
GENERAL DESCRIPTION

The booster is located between the master cylinder and the brake pedal. It is so designed that the force created when the brake pedal is depressed is mechanically increased combined with the engine vacuum. It provides higher brake force with less pedal effort.

The booster has a diaphragm of 155 mm effective diameter. Its operation is described in the following page.

NOTICE:

- Use all components included in repair kits to service this booster. Lubricate rubber parts, where indicated, with silicone grease provided in kits. The torque values specified are for dry, unlubricated fasteners. If any hydraulic component is removed or brake line disconnected, bleed the brake system.
- Never lubricate any hydraulic component with silicone grease.



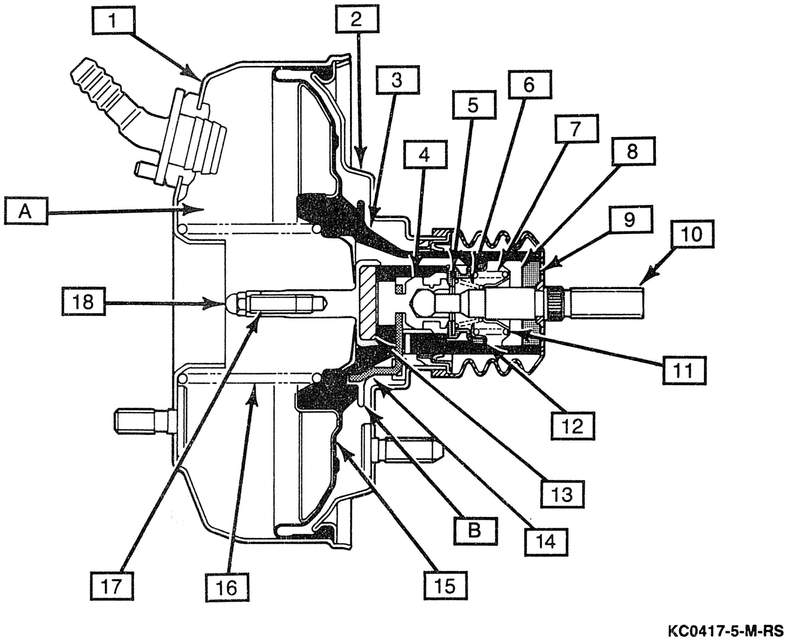
1	BOOSTER NO. 1 BODY
2	BOOSTER PISTON RETURN SPRING
3	ROD RETAINER
4	PISTON ROD
5	REACTION DISC
6	BOOSTER PISTON
7	VALVE STOPPER KEY
8	BOOSTER AIR VALVE ASSEMBLY
9	DIAPHRAGM
10	BOOSTER NO. 2 BODY
11	NO. 2 BODY OIL SEAL
12	AIR CLEANER SEPARATOR
13	AIR CLEANER ELEMENT
14	BODY BOOT
15	NUT
16	BRACKET
17	PIN
18	PUSH ROD CLEVIS
19	SPLIT PIN

KC0416-5-M-RS

Figure 5-8 Vacuum Booster Assembly - A

[Booster OPERATION]

A	CHAMBER
B	CHAMBER
1	BOOSTER NO. 1 BODY
2	BOOSTER NO. 2 BODY
3	BOOSTER PISTON
4	BOOSTER AIR VALVE
5	BOOSTER CONTROL VALVE
6	CONTROL VALVE SPRING
7	AIR VALVE RETURN SPRING
8	AIR CLEANER SEPARATOR
9	AIR CLEANER ELEMENT
10	VALVE OPERATING ROD
11	AIR VALVE SPRING RETAINER
12	CONTROL VALVE SPRING RETAINER
13	REACTION DISC
14	VALVE STOPPER KEY
15	REACTION DISC
16	BOOSTER DIAPHRAM
17	BOOSTER PISTON ROD
18	BOOSTER ROD ADJUST SCREW

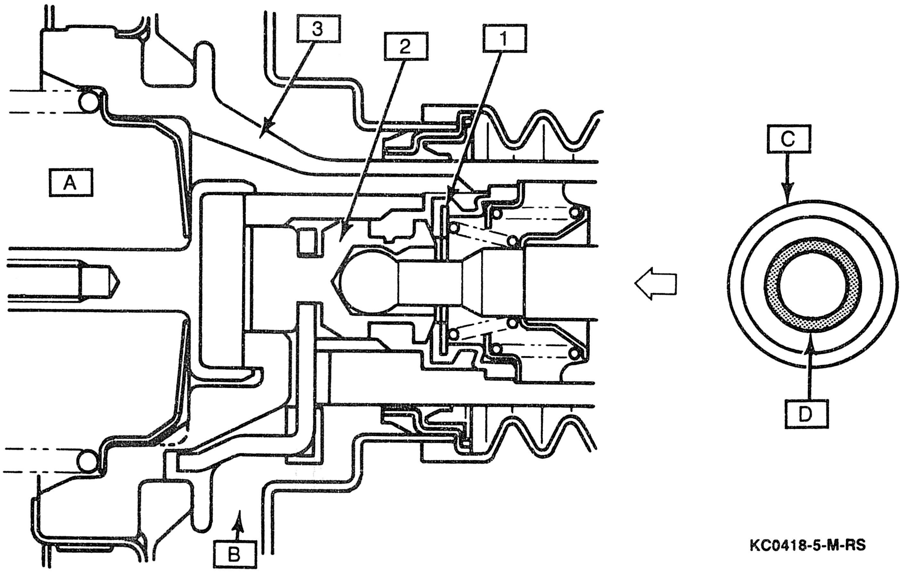


When the brake pedal is depressed, the force is transmitted to the piston of the master cylinder through the valve operating rod, booster air valve, reaction disc and piston rod. At the same time, the force of the booster piston developed due to the pressure difference between the two chambers "A" and "B" in the above figure is added to it.

The end of the booster control valve has a double function of a vacuum valve and air valve. That is, as shown in the figure, the booster control valve closes between the "A" and "B" chambers as its outer end "C" contacts the booster piston seat and opens as "C" leaves the booster piston seat (vacuum valve function). Also it closes between the "B" chamber and outside air as its inner end "D" contacts the air valve seat and opens as "D" leaves the air valve seat (air valve function).

[When brake pedal is not depressed]

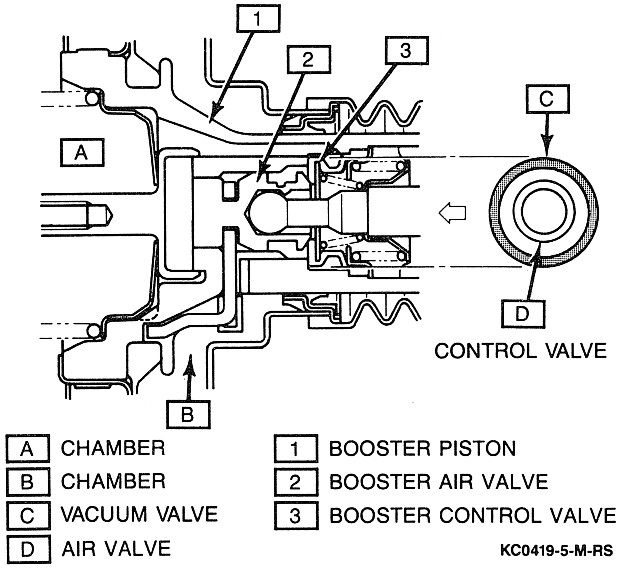
The valve operating rod is pushed to the right by the spring force as shown. The air valve is also enough to the right to contact the valve stopper key as shown. In this state, the vacuum valve (control valve "C") is open and the air valve (control valve "D") is closed. Thus the chambers "A" and "B" conduct and share the same negative pressure (because of no pressure difference) which allows the return spring to push the booster piston to the right.



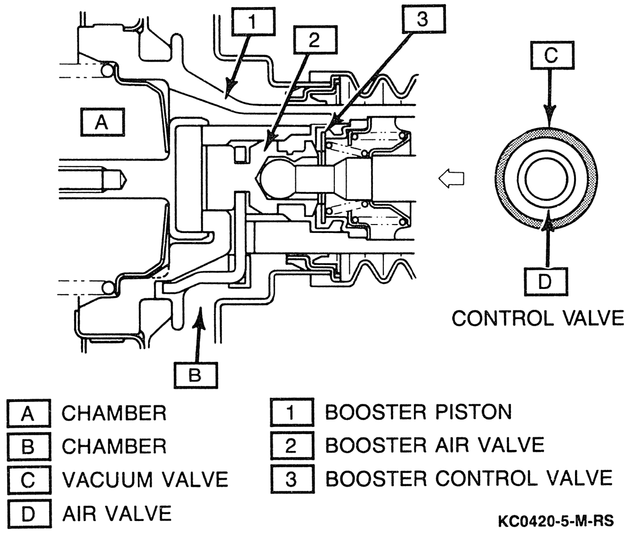
A	CHAMBER
B	CHAMBER
C	VACUUM VALVE
D	AIR VALVE
1	BOOSTER CONTROL VALVE
2	BOOSTER AIR VALVE
3	BOOSTER PISTON

Figure 5-9 Vacuum Booster Assembly - B

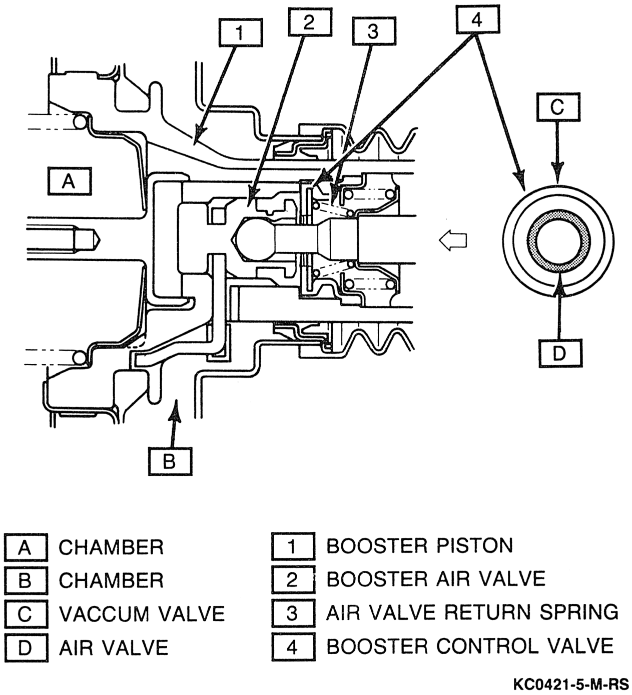
[When brake pedal is depressed]
Being pushed by the operating rod, the booster air valve moves to the left as shown. Then the control valve is pushed against the booster piston seat closely by the valve spring force. Thus the vacuum valve (control valve "C") is closed to cut off between the chambers "A" and "B". At this time the air valve (control valve "D") is still closed.


1
2
3
C
A
D
CONTROL VALVE
B
A CHAMBER
B CHAMBER
C VACUUM VALVE
D AIR VALVE
1 BOOSTER PISTON
2 BOOSTER AIR VALVE
3 BOOSTER CONTROL VALVE
KC0419-5-M-RS

As the booster air valve moves further to the left, it leaves the control valve and the air valve (control valve "D") opens to allow the air flow into the chamber "B". The entry of air causes a difference in pressures between the chambers "A" and "B". When this pressure difference grows greater than the piston return spring force, the booster piston moves to the left and the booster control valve also moves to the left. The resulting air valve (control valve "D") closure stops the air flow into the chamber "B" and its pressure remains as it is. In this way, a small brake pedal depressing force is made into a strong push to the master cylinder push rod to produce high hydraulic pressure.


1
2
3
C
A
D
CONTROL VALVE
B
A CHAMBER
B CHAMBER
C VACUUM VALVE
D AIR VALVE
1 BOOSTER PISTON
2 BOOSTER AIR VALVE
3 BOOSTER CONTROL VALVE
KC0420-5-M-RS

[When brake pedal is released]
When the brake pedal is released, the booster air valve returns to the right by the master cylinder piston return force and the air valve return spring force as shown. Then the vacuum valve (control valve "C") opens and causes negative pressure in the chamber "B". The result is that the master cylinder piston and booster piston return to their original positions. This is the same state as described under [When brake pedal is not depressed].


1
2
3
4
C
A
D
B
A CHAMBER
B CHAMBER
C VACCUM VALVE
D AIR VALVE
1 BOOSTER PISTON
2 BOOSTER AIR VALVE
3 AIR VALVE RETURN SPRING
4 BOOSTER CONTROL VALVE
KC0421-5-M-RS

[Reference]
Should any of the vacuum related parts in the booster be faulty, the brake force is not increased. Even then, however, the brake depressing force is transmitted to the valve operating rod, booster air valve, valve stopper key and booster piston in that order, to push the master cylinder push rod. Thus, the braking operation itself will not fail.

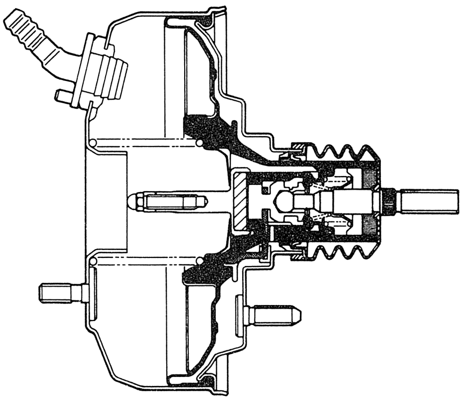

KC0422-5-M-RS

Figure 5-10 Vacuum Booster Assembly - C

DIAGNOSIS

ROAD TESTING BRAKES

Brakes should be tested on dry, clean, smooth and reasonably level roadway which is not crowned. Road test brakes by making brake applications with both light and heavy pedal forces at various speeds to determine if the car stops evenly and effectively. Also drive car to see if it leads to one side or the other without brake application. If it does, check the tire pressure, front end alignment and front suspension attachments for looseness. See diagnosis chart for other causes.

BRAKE FLUID LEAKS

With engine running at idle and the transmission in neutral, depress the brake pedal and hold a constant foot pressure on the pedal. If pedal gradually falls away with the constant pressure, the hydraulic system may be leaking. Check the master cylinder fluid levels. While a slight drop in reservoir level does result from normal lining wear, an abnormally low level indicates a leak in the system. In such a case, check the entire brake system for leakage. If even a slight evidence of leakage is noted, the cause should be corrected or defective parts should be replaced.

SUBSTANDARD OR CONTAMINATED BRAKE FLUID

Improper brake fluid, mineral oil or water in the fluid may cause the brake fluid to boil or the rubber components in the hydraulic system to deteriorate. If primary piston cups are swollen, then rubber parts have deteriorated. This deterioration may also be evidenced by swollen wheel cylinder piston cups on the drum brake wheels. If deterioration of rubber is evident, disassemble all hydraulic parts and wash with alcohol. Dry these parts with compressed air before assembly to keep alcohol out of the system. Replace all rubber parts in the system, including hoses. Also, when working on the brake mechanisms, check for fluid on the linings. If excessive fluid is found, replace the linings. If master cylinder piston seals are satisfactory, check for leakage or excessive heat conditions. If condition is not found, drain fluid, flush with brake fluid, refill and bleed system. The system must be flushed if there is any doubt as to the grade of fluid in the system or if fluid has been used which contained parts that have been subjected to contaminated fluid.

BRAKE DIAGNOSIS CHART A

Condition	Possible Cause	Correction
Not Enough Braking Force	1. Brake oil leakage from brake lines.	Locate leaking point and repair.
	2. Brake disc or pads stained with oil.	Clean or replace.
	3. Overheated brakes.	Determine cause and repair.
	4. Poor contact of shoes on brake drum.	Repair for proper contact.
	5. Brake shoes linings stained with oil or wet with water.	Replace.
	6. Badly worn brake shoe linings.	Replace.
	7. Defective wheel cylinders.	Repair or replace.
	8. Malfunctioning caliper assembly.	Repair or replace.
	9. Air in System.	Bleed System

Brake Pull (Brakes not working in unison)	1. Shoe linings are wet with water or stained with oil.	Replace.
	2. Drum-to-shoe clearance out of adjustment in some brakes. (Malfunctioning auto adjusting mechanism)	Check for inoperative auto adjusting mechanism.
	3. Drum is out of round in some brakes.	Replace.
	4. Wheel tires are inflated unequally.	Inflate equally.
	5. Malfunctioning wheel cylinders.	Repair or replace.
	6. Disturbed front end alignment.	Adjust as prescribed.
	7. Unmatched tires on same axle.	Tires with approximately the same amount of tread should be used on the same axle.
	8. Restricted brake tubes or hoses.	Check for soft hoses and damaged lines. Replace with new hoses and new double-walled steel brake tubing.
	9. Malfunctioning caliper assembly.	Check for stuck or sluggish pistons and proper lubrication of caliper slide bushing. Caliper should slide.
	10. Loose suspension parts.	Check all suspension **mountings.**
	11. Loose calipers.	Check and torque bolts to specifications.
Noise (High Pitched Squeak Without Brake Applied)	1. Front lining worn out.	Replace linings.

BRAKE DIAGNOSIS CHART B

Condition	Possible Cause	Correction
Excessive Pedal Travel (Pedal stroke too large)	1. Partial brake system failure.	Check diagonal brake systems and repair as necessary.
	2. Insufficient fluid in master cylinder reservoirs.	Fill reservoirs with approved brake fluid. Check for leaks and air in brake systems. Check warning light. Bleed system if required.
	3. Air in system. (Pedal soft/spongy).	Bleed system.
	4. Rear brake system not adjusted (malfunctioning auto adjusting mechanism)	Repair auto adjusting mechanism. Adjust rear brakes.
	5. Bent brake shoes.	Replace brake shoes.
	6. Worn rear brake shoes.	Replace brake shoes.
Dragging Brakes (A very light drag is present in all disc brakes immediately after pedal is released)	1. Master cylinder piston not returning correctly.	Repair master cylinder.
	2. Restricted brake tubes or hoses.	Check for soft hoses or damaged tubes and replace with new hoses and/or new double-walled steel brake tubing.
	3. Incorrect parking brake adjustment on rear brakes.	Check and adjust to correct specifications.
	4. Weakened or broken return springs in the brake.	Replace.
	5. Sluggish parking brake cables or linkage.	Repair or replace.
	6. Wheel cylinder or caliper piston sticking.	Repair as necessary.

Pedal Pulsation (Pedal pulsates when depressed for braking)	1. Damaged or loose wheel bearings.	Replace wheel bearings.
	2. Distorted steering knuckle or rear axle shafts.	Replace knuckle or rear axle shaft.
	3. Excessive disc lateral runout.	Check per instructions. If not within specifications, replace or machine the disc.
	4. Parallelism not within specifications.	Check per instructions. If not within specifications, replace or machine the disc.
	5. Rear drums out of round.	Check runout, if not within 0.06mm (0.0024 in.), replace drums. Original maximum diameter mustn't exceed 2.0mm (0.078 in.).
Braking Noise	1. Glazed shoe linings, or foreign matter stuck to linings.	Repair or replace shoe lining.
	2. Worn or distorted shoe linings.	Replace shoe lining (or pad).
	3. Loose front wheel bearings.	Replace wheel bearing.
	4. Distorted backing plates or loose mounting bolts.	Replace or retighten securing bolts.

ON-CAR SERVICE

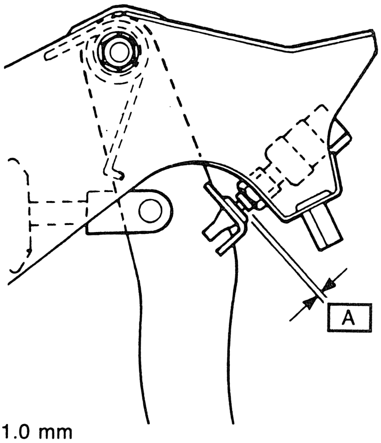
1. BRAKE PEDAL FREE HEIGHT ADJUSTMENT

The brake pedal height is normal if the brake pedal is about 8mm (0.3 in.) lower than clutch pedal.

1) When the booster push rod crevice has been reinstalled, it is important that the measurement between the booster mounting surface (with a gasket attached) and the center of the crevice pin hole is adjusted within 114.5 mm–115.5 mm (4.51–4.54 in.) (See Figure 5-42).
2) When the stoplamp switch has been removed, refer to the following STOPLAMP SWITCH ADJUSTMENT for proper installation.
   The services in above steps 1) and 2) may affect the brake pedal height.

2. STOPLAMP SWITCH ADJUSTMENT

Adjustment should be made as follows when installing the switch.
Pull up brake pedal toward you and while holding it there, adjust the switch position so that clearance between the end of thread and brake pedal contact plate (shown as "A" in figure) is within 0.5–1.0 mm (0.02–0.04 in.). Then tighten the lock nut to 13 N·m (10 lb.ft.).

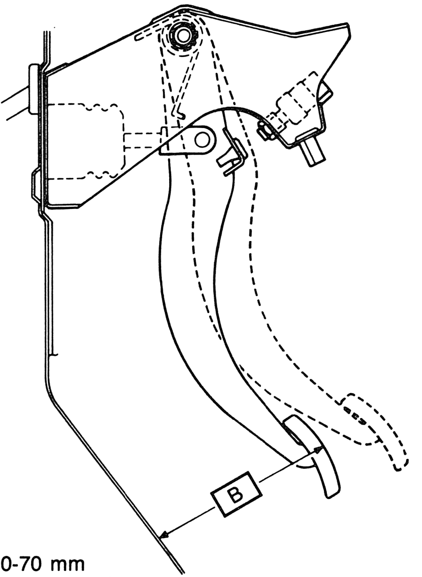


A 0.5-1.0 mm
(0.02-0.04 in)

KC0423-5-M-RS

3. EXCESSIVE PEDAL TRAVEL CHECK

1) Start engine.
2) Depress brake pedal a few times.
3) With brake pedal depressed with approximately 30 kg (66 lbs) load, measure pedal arm to wall clearance "B". It should be less than 60 mm (2.36 in.).



B 60-70 mm
(2.36-2.75 in)

KC0424-5-M-RS

4) If clearance "B" is less than 60 mm (2.36 in.), the most possible cause is either rear brake shoes are worn out beyond limit or air is in the lines. Should clearance "B" remain less than 60 mm (2.36 in.) even after replacement of brake shoes and bleeding of system. Another possible but infrequent cause is booster push rod length out of adjustment or malfunction of rear brake shoe adjusters.

- See Figure 5-12 for BRAKE SHOE INSPECTION
- See Figure 5-13, 5-14 for BLEEDING BRAKES
- REMOVE brake drums for adjuster inspection. (See Figure 5-27) If defective, correct or replace.

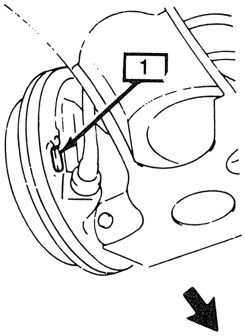
LC0006-5-M-RS

Figure 5-11 On-Car Service - A

4. REAR BRAKE SHOE INSPECTION

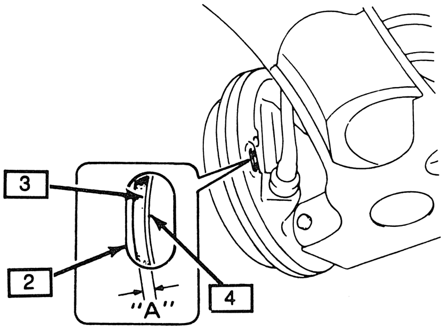
Inspection should be carried out on following points after brake pedal travel "B" (pedal arm to wall clearance) check as described in Item 3 (Figure 5-11) even when it is more than 60 mm (2.36 in.).

1.) Hoist car
2.) Remove rubber plug from brake back plate.
3.) Through oblong hole of back plate, visually check for thickness of brake shoe lining. If lining thickness "A" is found less than below specified wear limit, replace with new brake shoes.



1	RUBBER PLUG
2	OBLONG HOLE
3	BRAKE SHOE
4	BRAKE SHOE RIM

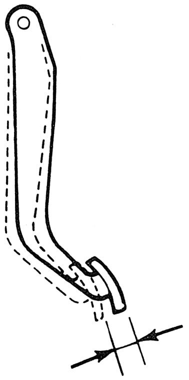
	Wear limit
Brake shoe lining thickness "A"	1.0 mm (0.039 in.)



5. BRAKE PEDAL PLAY INSPECTION

Pedal play should be within below specification. If out of specification, check stop light switch for proper installation position and adjust if necessary.

Also check pedal shaft bolt and master cylinder pin installation for looseness and replace if defective.



Pedal play: 1-8 mm
(0.04-0.32 in.)

6. REAR DRUM BRAKE SHOE ADJUSTMENT

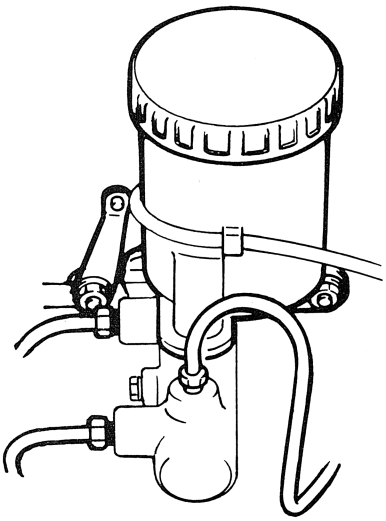
Rear brake has self-adjusting mechanism but it does require adjustment for proper drum to shoe clearance when brake shoe has been replaced or brake drum has been removed for some other service.

Adjustment is automatically accomplished by depressing brake pedal 3 to 5 times with approximately 30 kg (66 lbs) load after all parts are installed.

Then check brake drum for dragging and brake system for proper performance. After lowering car from lift, brake test should be performed.

7. MASTER CYLINDER INSPECTION

Check for a cracked master cylinder casting or brake fluid around the master cylinder. Leaks are indicated only if there is at least a drop of fluid. A damp condition is not abnormal.



KC0427-5-M-RS

8. DISC INSPECTION

Parallelism is the measurement of the thickness of the disc at four or more points around the circumference of the disc. All measurements must be made at the same distance in from the edge of the disc.

A disc that varies over 0.02 mm (0.0008 in.) causes pedal vibration as well as front end vibration during brake applications. A disc that does not meet these specifications should be refinished to specifications.

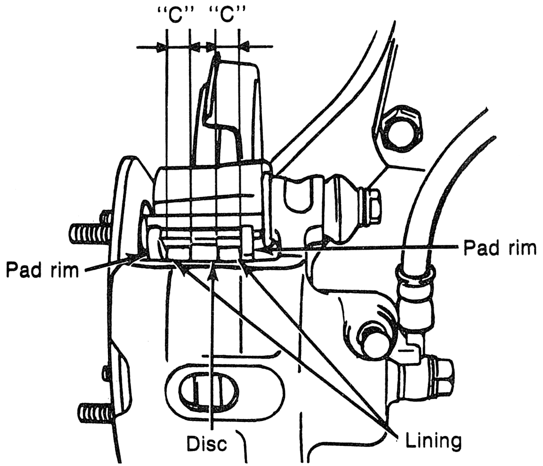
(See Figure 5-26)

LC0007-5-M-RS

Figure 5-12 On-Car Service - B

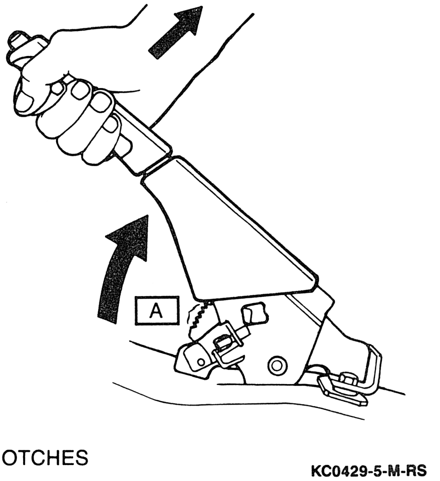
9. PAD LINING INSPECTION

Inspect pad linings periodically according to maintenance schedule and whenever wheels are removed (for tire rotation or other reason). Take a look through each end of caliper and check lining thickness of outside and inside pads.
If either end of either lining is worn and its thickness ("C" in figure) is less than 3 mm (0.12 in.), all pads must be replaced at the same time.



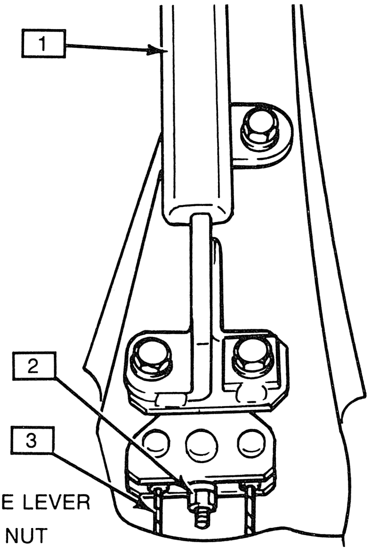
10. PARKING BRAKE INSPECTION AND ADJUSTMENT

a.) Inspection
Hold center of parking brake lever grip and pull it up with 20 to 25 kg (44 to 55 lbs) force. With parking brake lever pulled up, count ratchet notches in "A" as shown in figure. There should be 4-9 notches. Also check if both right and left rear wheels are locked firmly. If number of notches is out of specification, adjust cable by referring to adjustment procedure described on the following step b so as to obtain specified parking brake stroke.



b.) Adjustment
NOTE:
Make sure of the following conditions before cable adjustment:

- No air is trapped in system.
- Brake pedal travel is proper.
- Brake pedal has been depressed a few times with about 30 kg (66 lbs) pressure.
- Parking brake lever has been pulled up a few times with about 20 kg. force.
- Rear brake shoes are not worn beyond limit, and self-adjusting mechanism operates properly.



11. FLUSHING BRAKE HYDRAULIC SYSTEM

It is recommended that the entire hydraulic system be thoroughly flushed with clean brake fluid whenever new parts are installed in the hydraulic system.

12. BLEEDING BRAKES

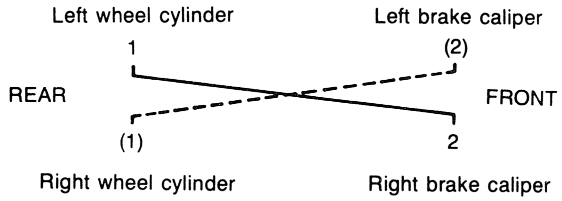
NOTICE:
Brake fluid is extremely damaging to paint. If fluid should accidentally touch a painted surface, immediately wipe fluid from paint and clean the painted surface.

A bleeding operation is necessary to remove air whenever it is introduced to the hydraulic brake system.

The hydraulic lines of this brake system are based on the diagonal split system. When a brake pipe or hose is disconnected at the wheel, bleeding operation must be performed at both ends of the line of the removed pipe or hose. When any joint part of the master cylinder or other joint part between the master cylinder and each brake (wheel) is removed, the hydraulic brake system must be bled at all 4 wheel brakes.

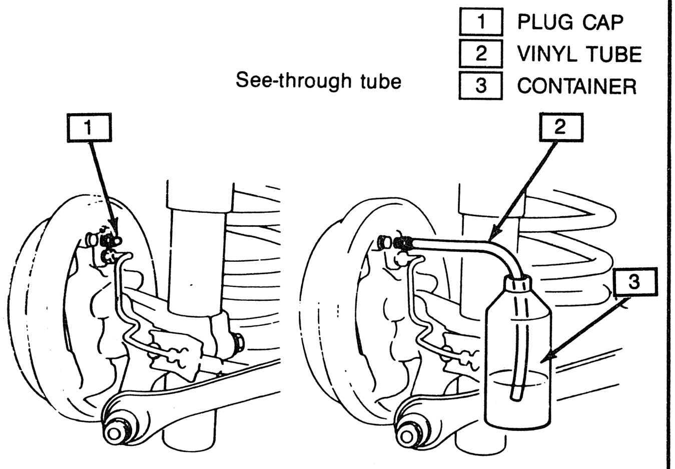
Figure 5-13 On-Car Service - C

NOTICE:
Perform bleeding operation starting with wheel cylinder farthest from master cylinder and then at front caliper of the same brake line. Do the same on the other brake line.

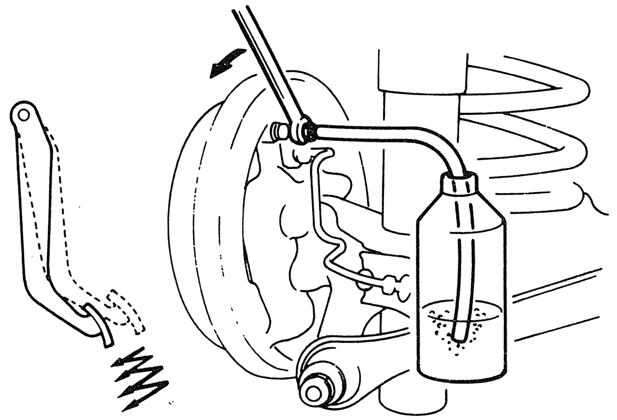

Left wheel cylinder
Left brake caliper
1
(2)
REAR
FRONT
(1)
2
Right wheel cylinder
Right brake caliper

1) Fill master cylinder reservoir with brake fluid and keep at least one-half full of fluid during bleeding operation.

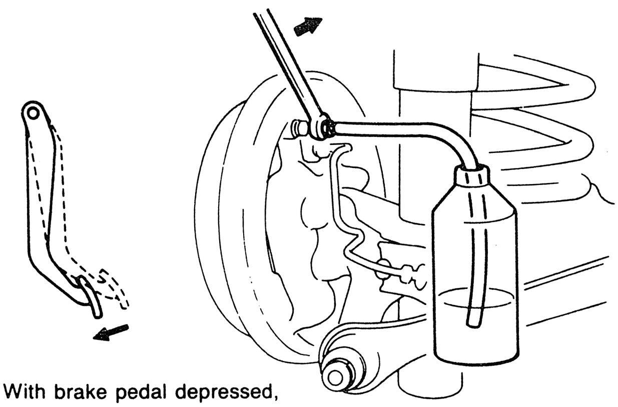
2) Remove bleeder plug cap.
Attach a vinyl tube to the bleeder plug of wheel cylinder, and insert the other end into a container.


1 PLUG CAP
2 VINYL TUBE
3 CONTAINER
See-through tube
1
2
3

3) Depress brake pedal several times, and then while holding it depressed, loosen bleeder plug about one-third to one-half turn.

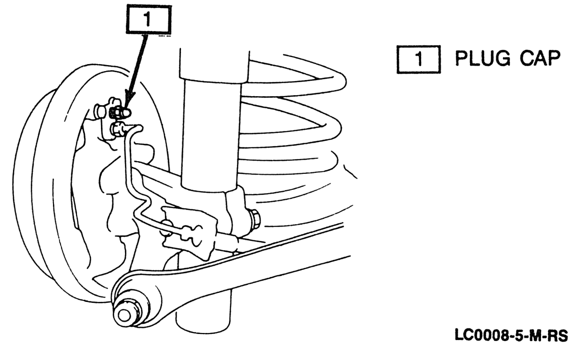


4) When the fluid pressure in the cylinder is almost depleted, retighten the bleeder plug.



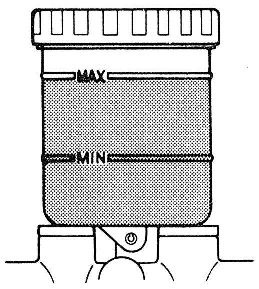
With brake pedal depressed, retighten bleeder plug.

5) Repeat this operation until there are no more air bubbles in hydraulic line.
6) When bubbles stop, depress and hold brake pedal and tighten bleeder plug.
7) Then attach bleeder plug cap.



LC0008-5-M-RS

8) After completing bleeding operation, apply fluid pressure to pipe line and check for leakage.
9) Replenish the fluid in the reservoir to specified level.



KC0436-5-M-RS

10) Check brake pedal for "sponginess". If found spongy, repeat entire procedure of bleeding.

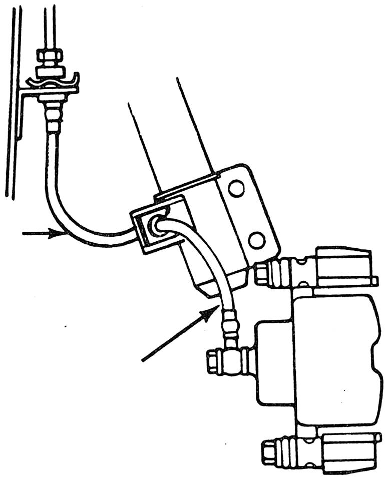
LC0008-5-M-RS

Figure 5-14 On-Car Service - D

13. BRAKE HOSE AND PIPE INSPECTION

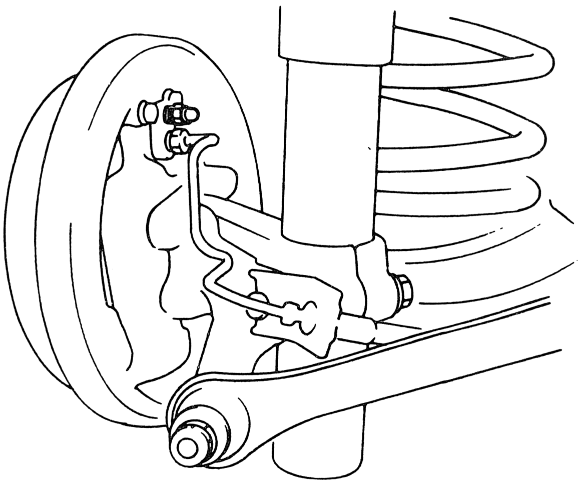
HOSE

The flexible hydraulic brake hose, which transmits hydraulic pressure from the steel brake line on the body to the rear cylinders and to the front calipers, should be inspected at least twice a year. The brake hose assembly should be checked for road hazard damage, for cracks and chafing of the outer cover, for leaks and blisters. A light and mirror may be needed for an adequate inspection. If any of the above conditions are observed on the brake hose, it will be necessary to replace it.



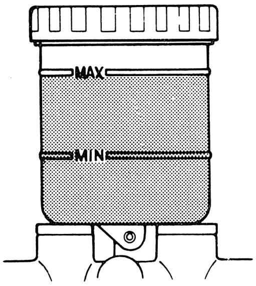
PIPE

Inspect the tube for damage, cracks, dents and corrosion. If any defect is found, replace it.



14. BRAKE FLUID LEVEL INSPECTION

Be sure to use the recommended brake fluid as marked on the reservoir cap of the master cylinder or as recommended in the owner's manual.
Use of any other fluid is strictly prohibited.
Fluid level should be between MIN and MAX lines marked on reservoir.
When warning light lights sometimes during driving, replenish fluid to MAX line.
When fluid decreases quickly, inspect brake system for leakage. Correct leaking points and then refill to specified level.



KC0439-5-M-RS

NOTICE:

Do not use shock absorber fluid or any other fluid which contains mineral oil. Do not use a container which has been used for mineral oil or a container which is wet from water. Mineral oil will cause swelling and distortion of rubber parts in hydraulic brake system and water mixed into brake fluid will lower fluid boiling point. Keep all fluid containers capped to prevent contamination.

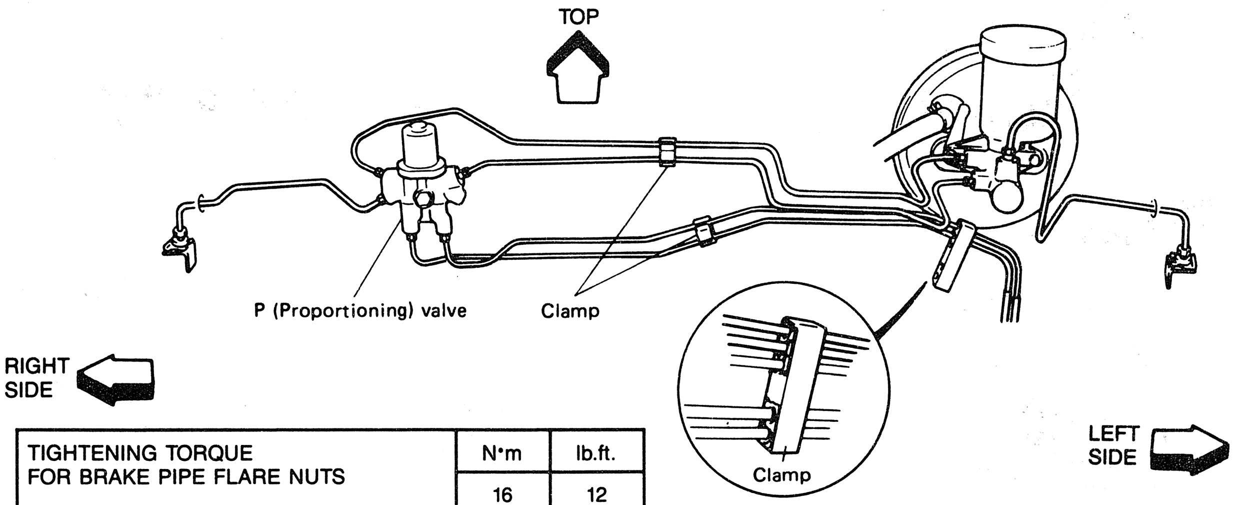
LC0009-5-M-RS

Figure 5-15 On-Car Service - E

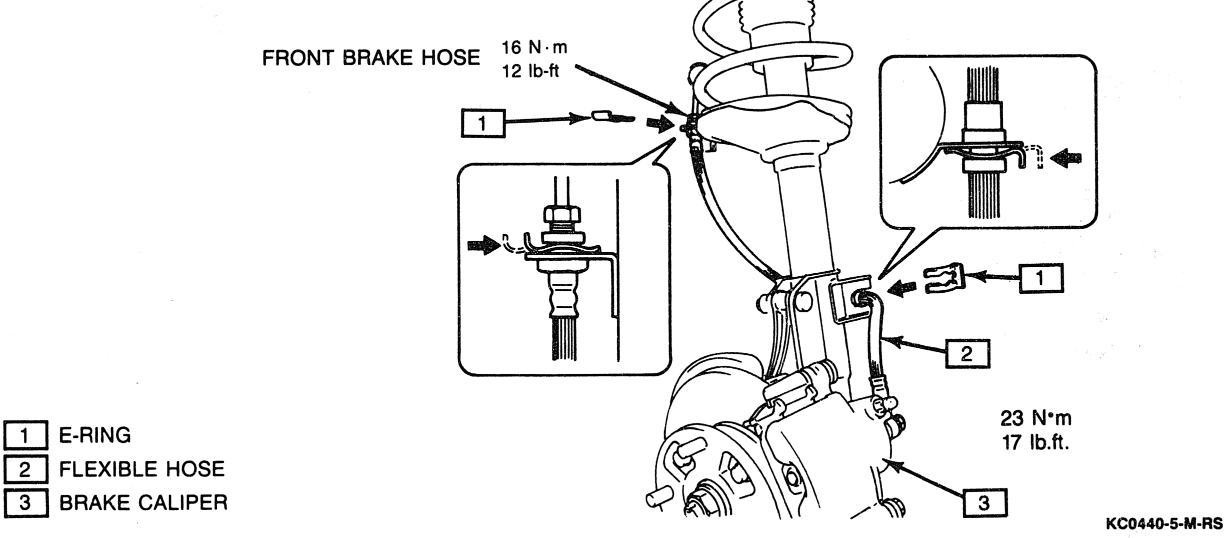
BRAKE HOSE/PIPE R & I

1. REMOVE AND INSTALL FRONT BRAKE HOSE/PIPE

1) Raise and suitably support car.
   This operation is not necessary when removing pipes connecting master cylinder and proportioning valve.
2) Clean dirt and foreign material from both hose end or pipe end fittings. Remove brake hose or pipe.
3) Reverse procedure for brake hose installation. When installing hose, make sure that it has no twists or kinks. Inspect to see that hose doesn't make contact with any part of suspension. Check in extreme right and extreme left turn conditions. If hose makes any contact, remove and correct. Fill and maintain brake fluid level in reservoir. Bleed brake system.


TOP
P (Proportioning) valve
Clamp
Clamp
RIGHT SIDE
LEFT SIDE

TIGHTENING TORQUE FOR BRAKE PIPE FLARE NUTS	N•m	lb.ft.
	16	12
TIGHTENING TORQUE FOR PROPORTIONING VALVE BOLT	10	7


FRONT BRAKE HOSE
16 N·m
12 lb-ft
1
1
2
3
23 N•m
17 lb.ft.
1 E-RING
2 FLEXIBLE HOSE
3 BRAKE CALIPER
KC0440-5-M-RS

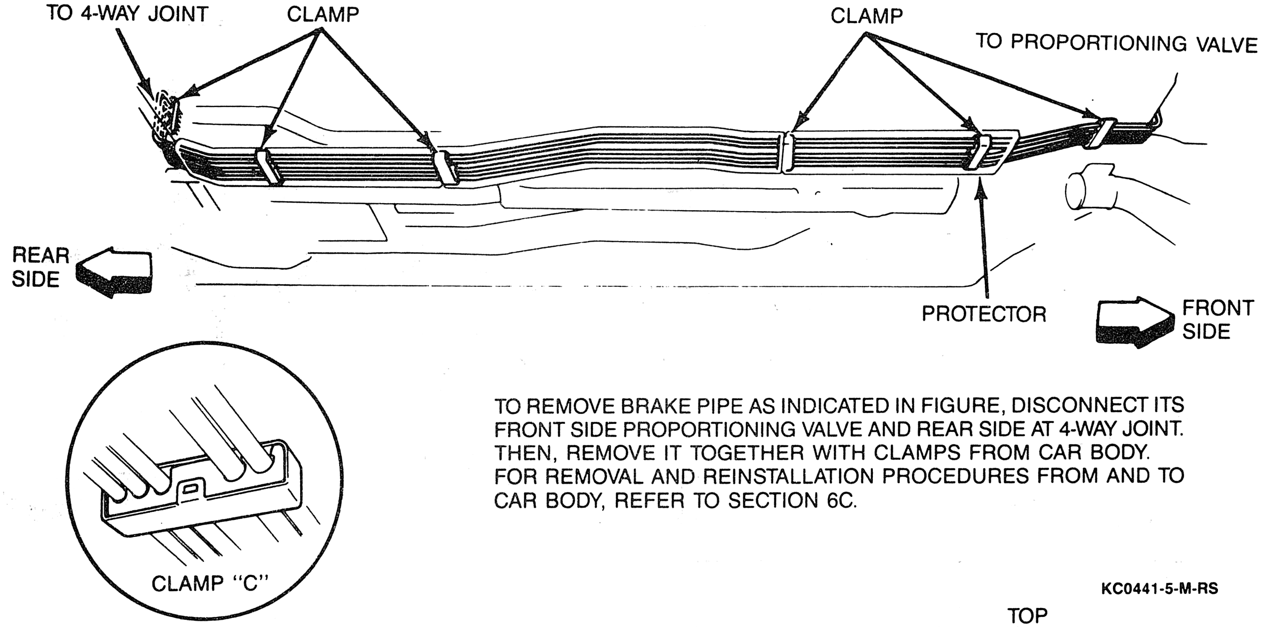
LC0010-5-M-RS

Figure 5-16 Front Brake Hose/Pipe R&I

2. REMOVE AND INSTALL REAR BRAKE HOSE/PIPE

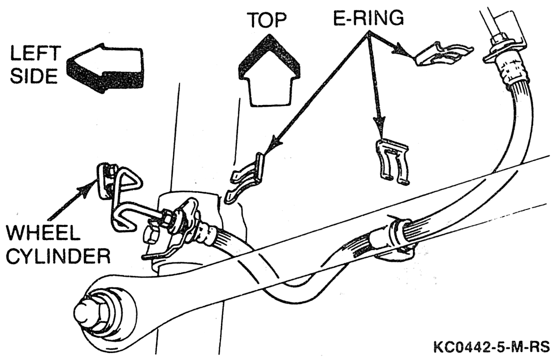
1) Raise and suitably support car.
2) Clean dirt and foreign material from both hose ends or pipe end fittings.
3) Remove 3 brake and fuel pipe guards.
4) To remove brake pipes, disconnect its front side at proportioning valve and the rear side at the 4 way joint.
5) For removal and installation procedures, refer to Section 6C Fuel.

NOTICE:
Never reuse protector (guard) nut once removed. Be sure to use a new one.
Install clamps properly, referring to Figure below and tighten bolts. When installing hose, make sure it has no twists or kinks.

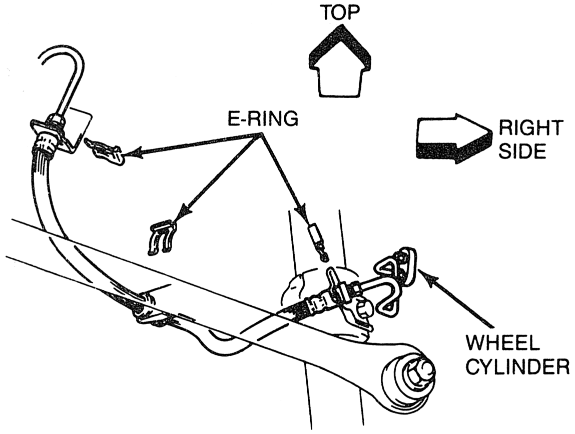

TO 4-WAY JOINT
CLAMP
CLAMP
TO PROPORTIONING VALVE
REAR SIDE
PROTECTOR
FRONT SIDE
CLAMP "C"

TO REMOVE BRAKE PIPE AS INDICATED IN FIGURE, DISCONNECT ITS FRONT SIDE PROPORTIONING VALVE AND REAR SIDE AT 4-WAY JOINT. THEN, REMOVE IT TOGETHER WITH CLAMPS FROM CAR BODY. FOR REMOVAL AND REINSTALLATION PROCEDURES FROM AND TO CAR BODY, REFER TO SECTION 6C.

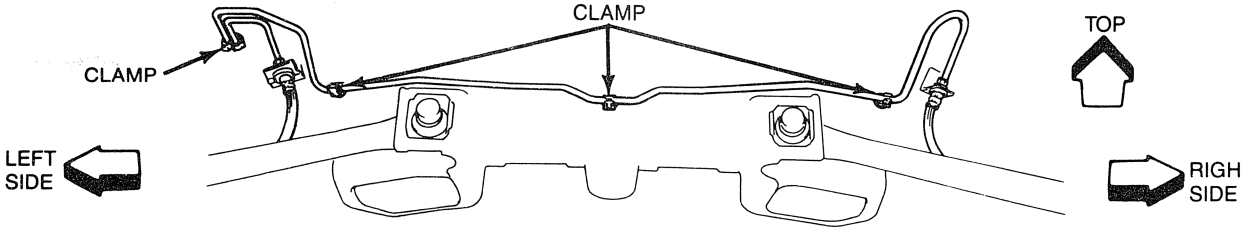
KC0441-5-M-RS


LEFT SIDE
TOP
E-RING
WHEEL CYLINDER

KC0442-5-M-RS


TOP
E-RING
RIGHT SIDE
WHEEL CYLINDER

KC0444-5-M-RS


CLAMP
CLAMP
TOP
LEFT SIDE
RIGHT SIDE

TIGHTENING TORQUE FOR BRAKE PIPE FLARE NUT	N·m	lb.ft.
	16	12

LC0011-5-M-RS

Figure 5-17 Rear Brake Hose/Pipe R&I

PARKING BRAKE LEVER/CABLE R & I

1. REMOVE AND INSTALL PARKING BRAKE LEVER

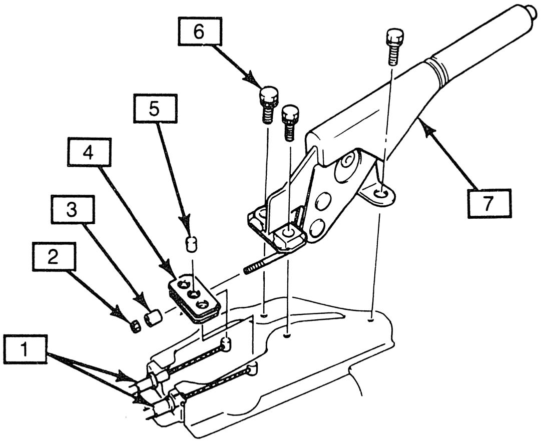
REMOVE OR DISCONNECT

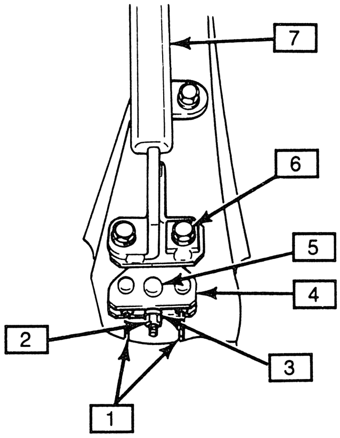
1) Remove parking brake lever cover.
2) Disconnect lead wire of parking brake switch at connector.
3) Remove parking brake cable locking nut.
4) Remove parking brake lever bolts and then remove parking brake lever assembly from equalizer.
5) Remove equalizer from parking brake cable.

NOTICE:
Do not disassemble parking brake lever switch. It must be removed and installed as a complete switch assembly.

INSTALL OR CONNECT

1) Install in reverse order of REMOVAL procedure. Tighten parking brake lever bolts to 13 N•m (10 lb.ft.).
2) After all parts are installed, parking brake lever needs to be adjusted. Refer to PARKING BRAKE INSPECTION AND ADJUSTMENT Figure 5-13.
3) Check brake drum for dragging and brake system for proper performance.





1	PARKING BRAKE CABLE	5	PIN
2	BRAKE CABLE LOCKING NUT	6	PARKING BRAKE LEVER BOLT
3	SPACER	7	PARKING BRAKE LEVER ASSEMBLY
4	EQUALIZER		

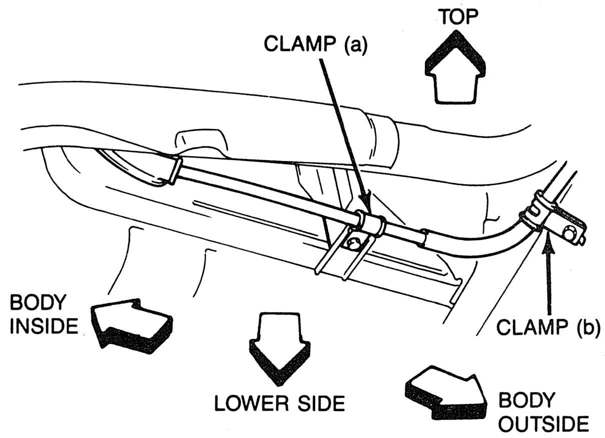
KC0445-5-M-RS

Figure 5-18 Parking Brake Lever R&I

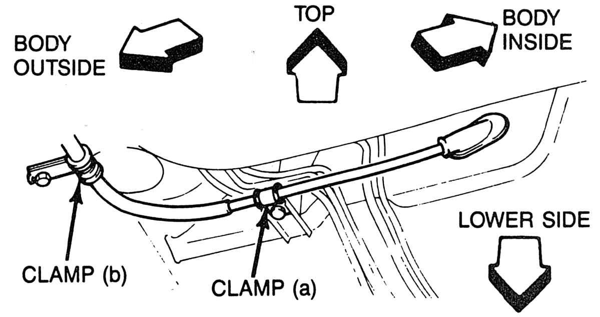
2. REMOVE AND INSTALL PARKING BRAKE CABLE

REMOVE OR DISCONNECT

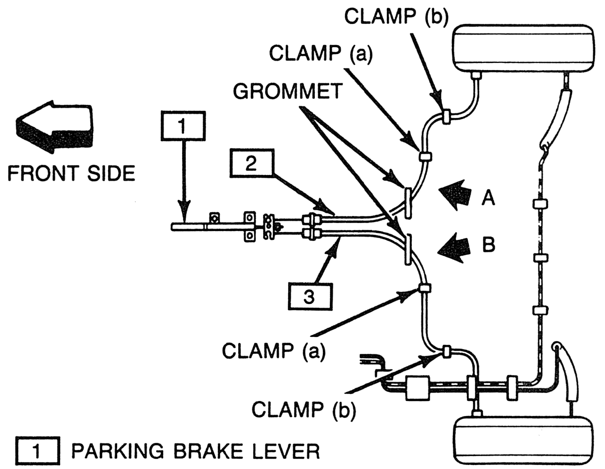
1) Remove brake drum. (Refer to steps 1 – 6 of BRAKE DRUM REMOVAL Fig. 5-27).
2) Disconnect parking brake cable from brake shoe lever. (Refer to steps 2 & 3 of BRAKE SHOE REMOVAL Fig. 5-29).
3) Disconnect brake cable from brake back plate.
4) Disconnect cable from parking brake lever. (Refer to steps 1 –10 of BRAKE LEVER REMOVAL Fig. 5-18).


TOP
CLAMP (a)
BODY INSIDE
CLAMP (b)
LOWER SIDE
BODY OUTSIDE

VIEWED FROM ARROW "A" KC0449-5-M-RS


TOP
BODY OUTSIDE
BODY INSIDE
LOWER SIDE
CLAMP (b)
CLAMP (a)

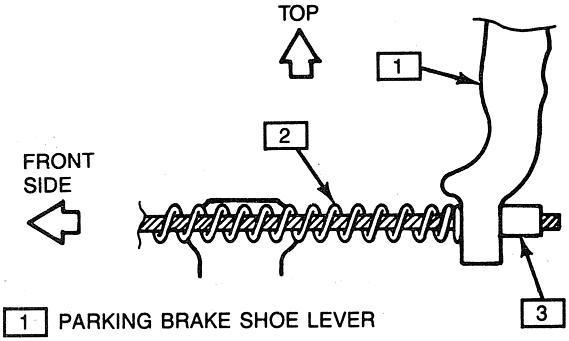
VIEWED FROM ARROW "B" KC0451-5-M-RS


CLAMP (b)
CLAMP (a)
GROMMET
FRONT SIDE
1
2
A
B
3
CLAMP (a)
CLAMP (b)

1 PARKING BRAKE LEVER
2 PARKING BRAKE CABLE (RIGHT SIDE)
3 PARKING BRAKE CABLE (LEFT SIDE) KC0450-5-M-RS

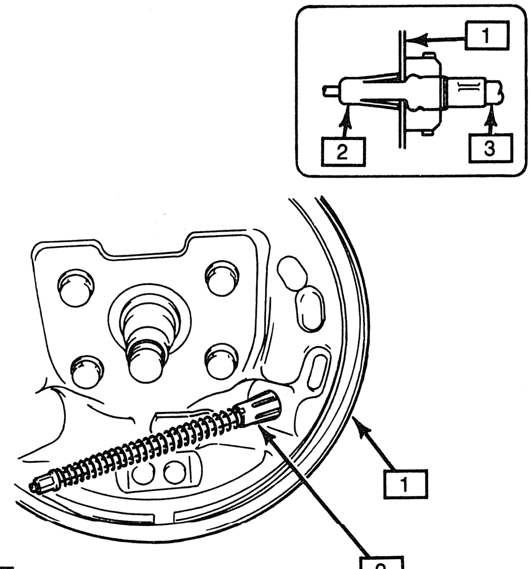
INSTALL OR CONNECT

1) Brake cable stopper ring to brake back plate securely, as shown in Figure below.


TOP
1
2
FRONT SIDE
3

1 PARKING BRAKE SHOE LEVER
2 SPRING
3 NIPPLE END KC0447-5-M-RS

2) Install brake cable spring and nipple end to parking brake shoe lever securely, as shown below.



1 BRAKE BACK PLATE
2 CABLE STOPPER RING
3 BRAKE CABLE KC0446-5-M-RS

3) Install brake shoes to back plate. (Refer to steps 1 & 2 of BRAKE SHOE INSTALLATION of this section).
4) Install brake drum. (Refer to steps 1 - 7 of BRAKE DRUM INSTALLATION Figures 5-27, 5-28).
5) For proper routing and secure clamping of parking brake cable refer to Figures at left.
6) Connect cable to parking brake lever. Refer to Brake Lever Installation.
7) Upon completion of installation, adjust cable (Refer to Parking Brake Inspection and Adjustment in this section. Then check brake drum for dragging and brake system for proper performance.
8) Brake test car.

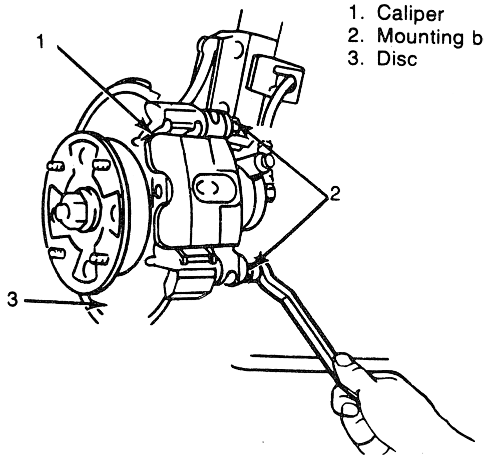
Figure 5-19 Parking Brake Cable R&I

DISC BRAKE R & I

1. REMOVE AND INSTALL PAD (SHOE & LINING)

REMOVE OR DISCONNECT

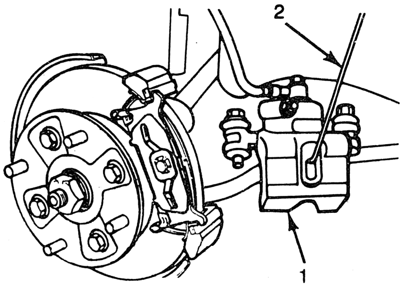
1) Hoist car and remove wheel.
2) Remove caliper mounting bolts.



1. Caliper
2. Mounting bolts
3. Disc

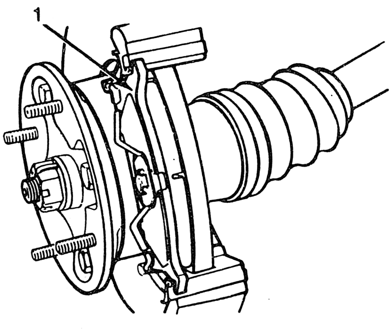
3) Remove caliper from knuckle. Be careful not to drop inside pad which will come off with caliper.

NOTICE:
Hang removed caliper with a wire hook or the like to prevent brake hose from bending and twisting excessively or being pulled.



1. Caliper
2. Wire hook

4) Remove outside pad.

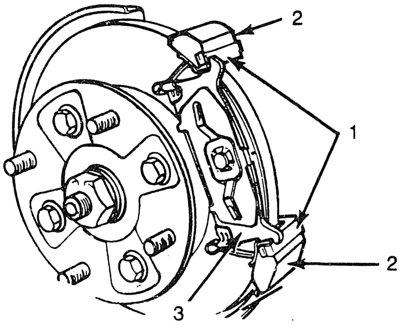


1. Outside pad

INSTALL OR CONNECT

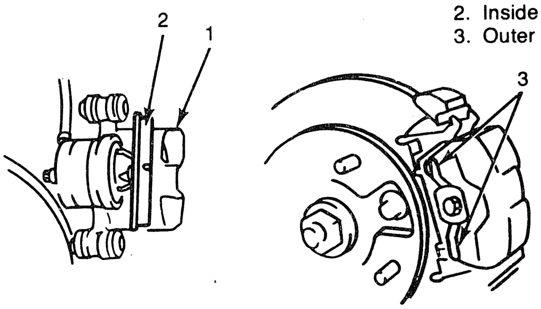
NOTICE:
See NOTICE at the beginning of this section.

1) Install pad clips (No. 1 & No. 2) and then outside pad to knuckle as shown.



1. Pad clips
2. Knuckle
3. Outside pad

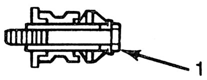
2) Put caliper and inside pad together and install them to knuckle as shown, putting outer springs 3 in place over caliper as shown.

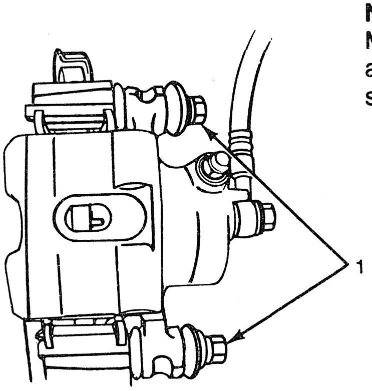


1. Caliper
2. Inside pad
3. Outer springs

3) Torque caliper mounting bolts to specification.

NOTICE:
Make sure that boots are fit into groove securely.





24-36 N-m
(2.4-3.6 kg-m)
(17.5-26.0 lb-ft)

1. Caliper mounting bolts

4) Torque front wheel nuts to specification.

N-m	kg-m	lb-ft
55	5.5	41

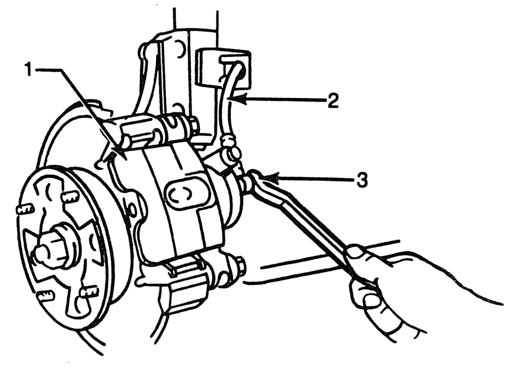
5) Upon completion of installation, perform brake test.

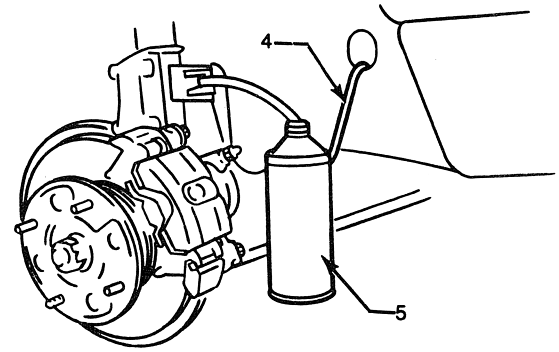
Figure 5-20 Caliper R&I

2. REMOVE AND INSTALL CALIPER ASSEMBLY

REMOVE OR DISCONNECT

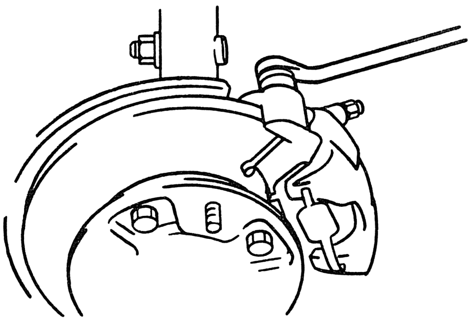
1) Hoist car and remove wheel.
2) Remove brake flexible hose mounting bolt from caliper. As this will allow fluid to flow out of hose, have a container ready beforehand.





1. Caliper
2. Flexible hose
3. Hose mounting bolt
4. Wire hook
5. Container

3) Remove caliper mounting bolts.

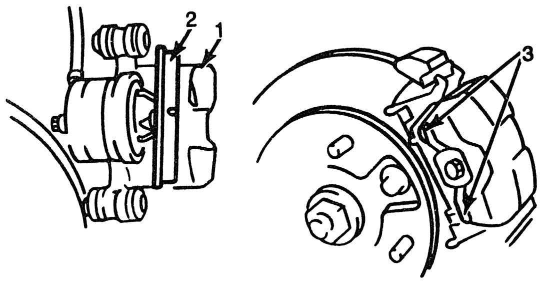


4) Remove caliper from knuckle. Be careful not to drop inside pad which will come off with caliper.

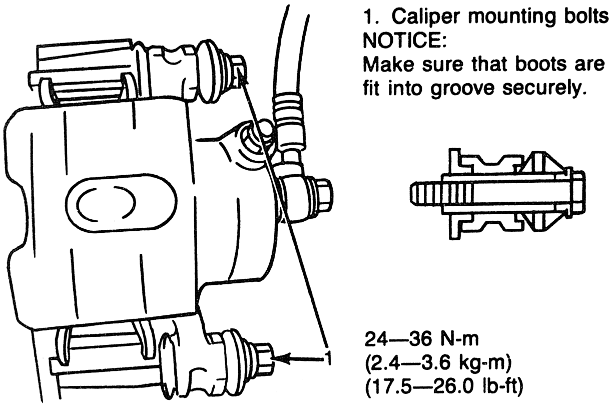
INSTALL OR CONNECT

1) Put caliper and inside pad together and install them to knuckle as shown, putting outer springs in place over caliper as shown.

1. Caliper
2. Inside pad
3. Outer springs



2) Torque caliper mounting bolts to specification.

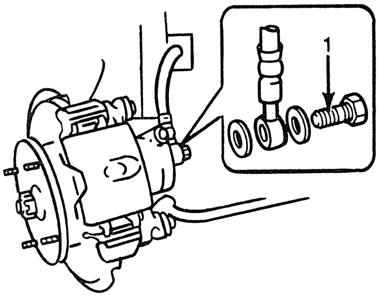


1. Caliper mounting bolts

NOTICE:
Make sure that boots are fit into groove securely.

24—36 N-m
(2.4—3.6 kg-m)
(17.5—26.0 lb-ft)

3) Install brake flexible hose as shown and torque hose mounting bolt to specification.



1. Flexible hose bolt
20-25 N-m
(2.0-2.5 kg-m)
(14.5-18.0 lb-ft)

4) Torque wheel nuts to specification.

N-m	kg-m	lb-ft
55	5.5	41

5) After completing installation, fill reservoir with brake fluid and bleed brake system. Perform brake test and check each installed part for oil leakage.

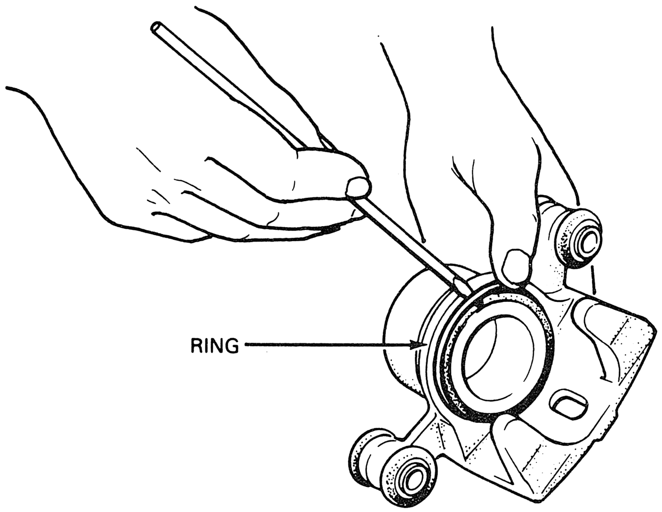
Figure 5-21 Shoe and Lining R&I

3. REMOVE AND INSTALL SEAL, PISTON, DUST BOOT AND BLEEDER SCREW

REMOVE OR DISCONNECT

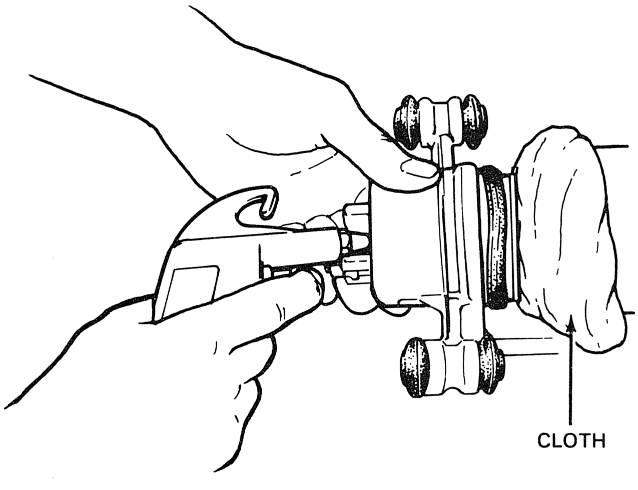
Before disassembly, clean all around caliper with brake fluid.

1) Remove cylinder boot set ring and boot from cylinder groove.



2) Blow compressed air into cylinder through bolt hole, where flexible hose was fitted. With this air pressure, piston can be pushed out of cylinder.

CAUTION:
Do not apply too highly compressed air which will cause piston to jump out of cylinder. It should be taken out gradually with moderately compressed air. Do not place your fingers in front of piston when using compressed air.



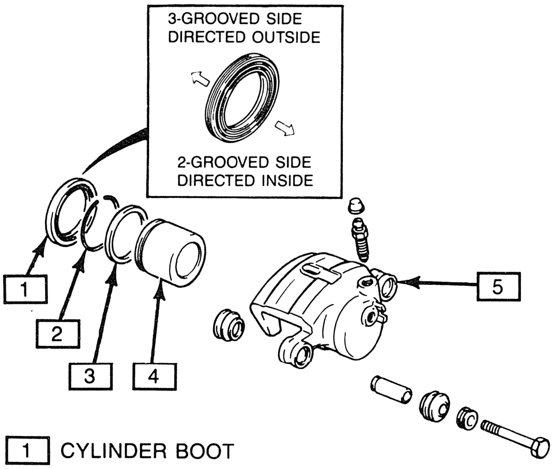
INSTALL OR CONNECT

Reassemble front brake in the reverse order of disassembly, noting the following points.

NOTICE:

- **Wash each part cleanly before installation in the same fluid as the one used in master cylinder reservoir.**
- **Never use other fluid or thinner.**
- **Before installing piston and piston seal to cylinder, apply fluid to them.**
- **After reassembling brake line, bleed air from line.**

1) **Piston seal**
   The piston seal is used to seal the piston to the cylinder and to adjust the clearance between the pads and disc. Replace seal at every overhaul. Fit piston seal into groove in cylinder, taking care not to twist it.
2) **Piston and boot**
   Before inserting piston into cylinder, boot must be fitted in piston.
   Make sure to fit boot in proper direction as shown below.


3-GROOVED SIDE DIRECTED OUTSIDE
2-GROOVED SIDE DIRECTED INSIDE
1
2
3
4
5

1	CYLINDER BOOT
2	BOOT RING
3	PISTON SEAL
4	PISTON
5	CALIPER

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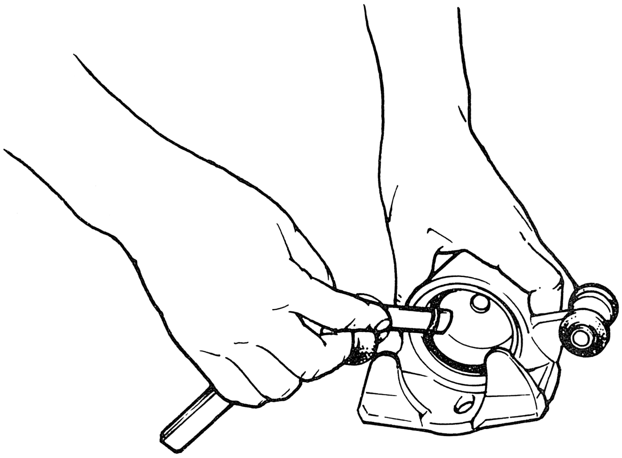
When installing boot to cylinder, position outer end of piston so that it projects out of the end of cylinder by about 10 mm (0.4 in.), this will facilitate installation. Install boot set ring.

Figure 5-22 Caliper Repair - A

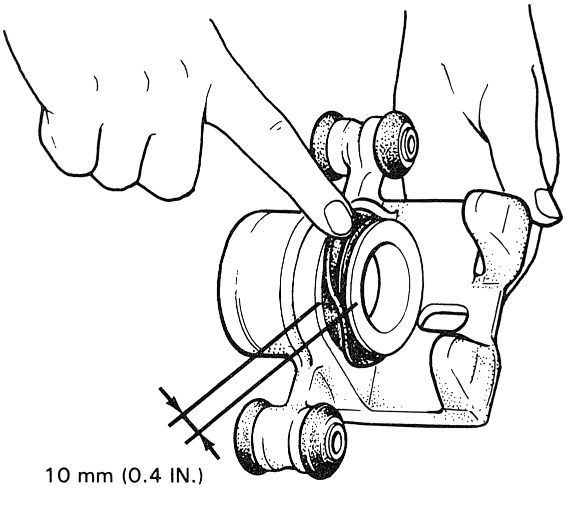
REMOVE OR CONNECT

3) Remove piston seal using a thin blade like a thickness gauge, etc.

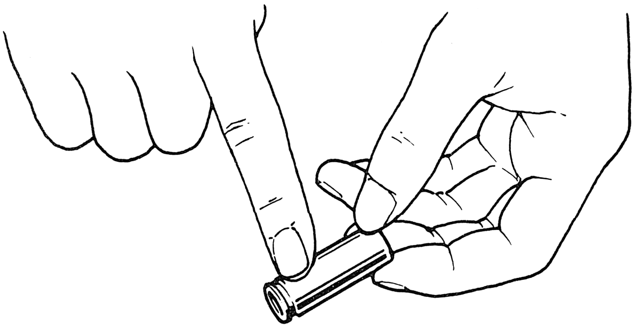
NOTICE:
Be careful not to damage inside (bore side) of cylinder.



INSTALL OR CONNECT



3) **Caliper**
Before installing caliper (cylinder body) to knuckle, check to ensure that the slide bushings (2 pcs) are greased with rubber and that the slide bushing inserted in each carrier hole can be moved smoothly in the thrust direction.



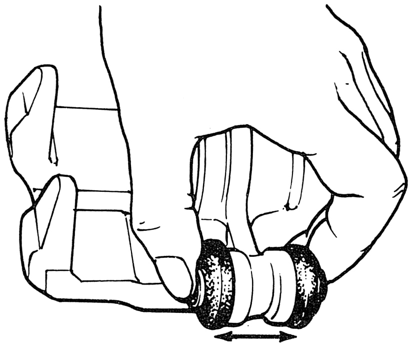
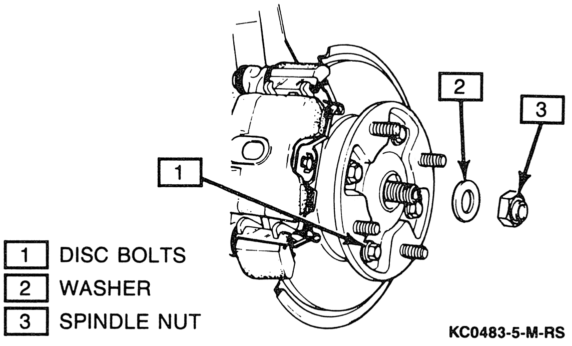


Figure 5-23 Caliper Repair - B

4. REMOVE AND INSTALL DISC

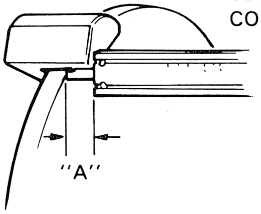
REMOVE OR DISCONNECT

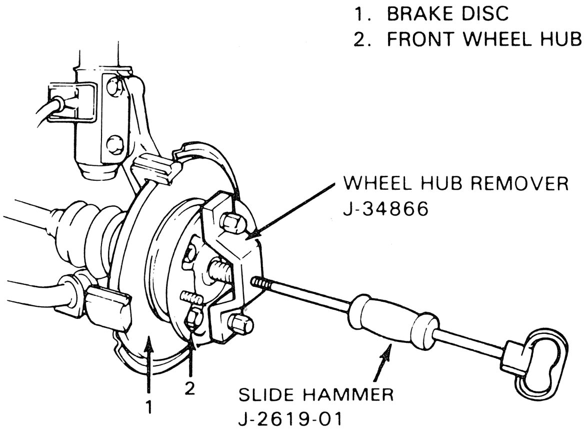
1) Hoist car and remove wheel.
2) Uncaulk spindle nut.
3) With foot brake pedal depressed by another person, loosen disc bolts until they can be turned by hand and remove spindle nut.


1
2
3
1 DISC BOLTS
2 WASHER
3 SPINDLE NUT
KC0483-5-M-RS

4) Remove caliper and pads, referring to steps 2) - 4) of REMOVAL procedure in this section.
5) Pull out wheel hub by using special tools as shown.

WRITE DOWN MEASUREMENT INDICATED BY "A" IN FIGURE BEFORE REMOVING HUB FOR THE CONVENIENCE OF INSTALLATION.

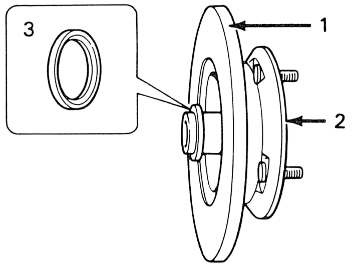



1. BRAKE DISC
2. FRONT WHEEL HUB
WHEEL HUB REMOVER
J-34866
SLIDE HAMMER
J-2619-01
1
2

6) Remove brake disc from wheel hub.

INSTALL OR CONNECT

1) Install disc to wheel hub temporarily.
2) Insert spacer into wheel hub. See figure for its installing direction.

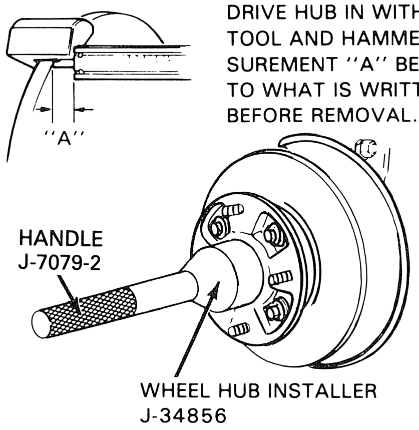


1. DISC 2. WHEEL HUB 3. SPACER

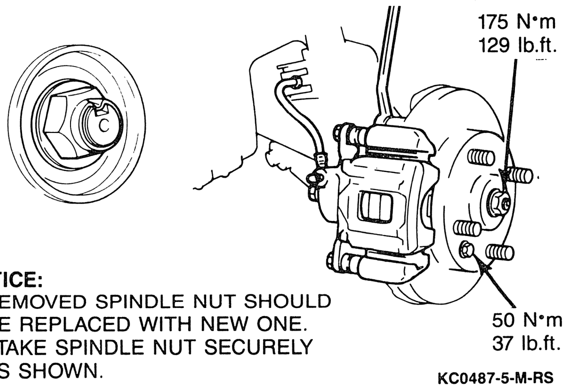
NOTICE:
Before installing wheel hub to knuckle see step 3 of WHEEL HUB INSTALLATION Section 3C, for wheel bearing spacer alignment.

3) While turning hub, drive it in with plastic hammer until hub center comes out (until its even installation is confirmed).

DRIVE HUB IN WITH SPECIAL TOOL AND HAMMER UNTIL MEASUREMENT "A" BECOMES CLOSE TO WHAT IS WRITTEN DOWN BEFORE REMOVAL.


"A"
HANDLE
J-7079-2
WHEEL HUB INSTALLER
J-34856

4) Install pads and caliper, referring to steps 1 — 3 of INSTALLATION Fig. 5-20.
5) Torque disc bolts and spindle nut to specifications.


175 N•m
129 lb.ft.
50 N•m
37 lb.ft.
KC0487-5-M-RS

NOTICE:
- REMOVED SPINDLE NUT SHOULD BE REPLACED WITH NEW ONE.
- STAKE SPINDLE NUT SECURELY AS SHOWN.

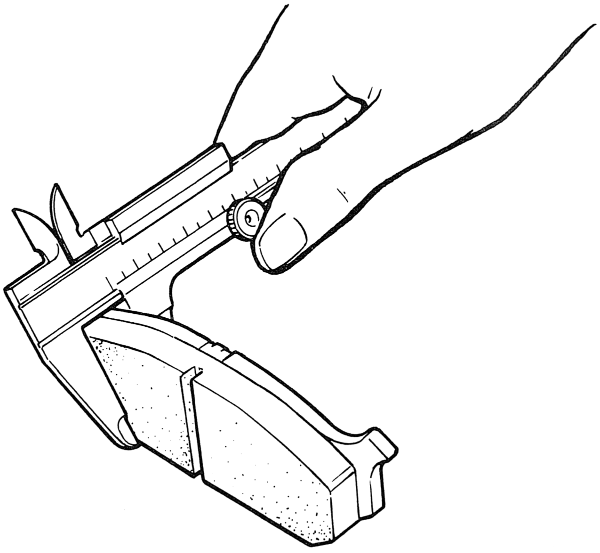
6) Perform steps 4 and 5 of INSTALLATION Fig. 5-20.

Figure 5-24 Disc R&I

DISC BRAKE INSPECTION

1. INSPECT BRAKE PAD LINING

Check pad lining for wear. When wear exceeds limit, replace with new ones.



NOTICE:
Never polish pad lining with sandpaper. If lining is polished with sandpaper, hard particles of sandpaper will be deposited in lining and may damage disc. When pad lining requires correction, replace.

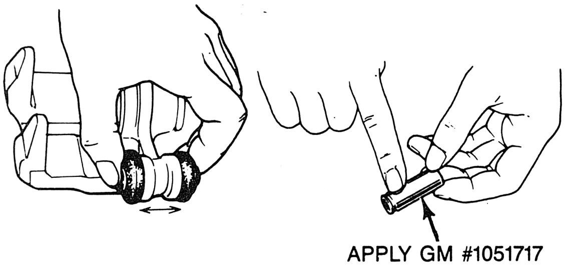
Pad thickness (lining + pad rim)	Standard	Limit
	15.0 mm (0.590 in.)	8.0 mm (0.315 in.)

NOTICE:
When pads are removed, visually inspect caliper for brake fluid leak. Correct leaky point, if any.

2. INSPECT BRAKE CALIPER INNER PARTS

Cylinder slide bushing

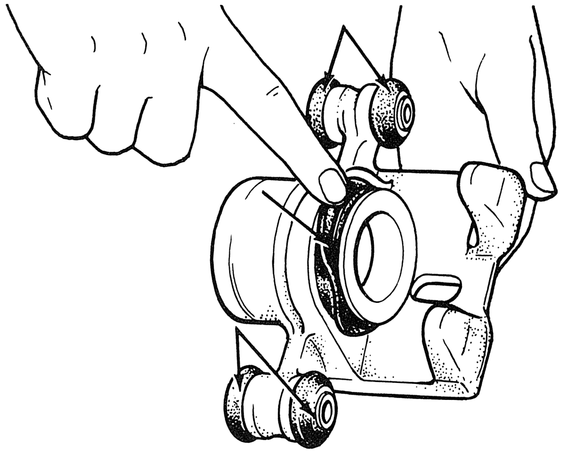
Check bushing for smooth movement as shown. If it is found faulty, correct or replace. Apply GM #1051717 Rubber Lube to bushing outer surface. Rubber grease should be the one whose viscosity is less affected by such low temperatures as -40°C (-40°F).



KC0493-5-M-RS

Bushing dust boot and cylinder boot

Check boots for breakage, crack and damage. If defective, replace.



Piston seal

Excessive or uneven wear of pad lining may indicate unsmooth return of the piston. In such a case, replace the rubber seal.

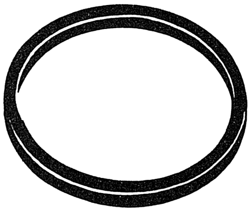
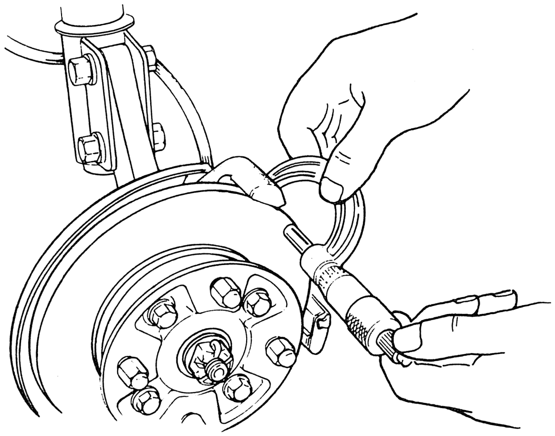


Figure 5-25 Disc Brake Inspection - A

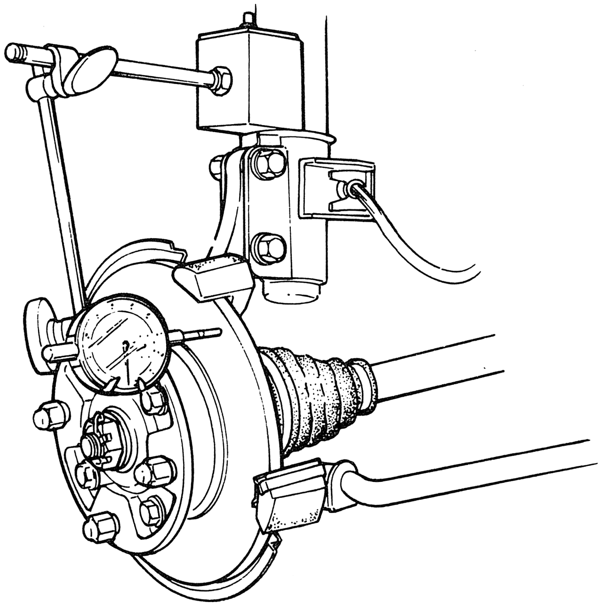
3. INSPECT BRAKE DISC

Before this inspection, brake pads must be removed (according to steps 1 — 4, PAD REMOVAL Fig. 5-20).

Check the disc surface for scratches in wearing parts. Scratches on the disc surface noticed at the time of the specified inspection or replacement are normal and the disc is not defective if these are not serious. But when there are deep scratches or scratches all over the surface, replace the disc. When only one side is scratched, polish and correct that side.



	Standard	Limit
Disc thickness	10 mm (0.394 in.)	8.0 mm (0.315 in.)



To measure the deflection of a disc, make measurements, at 2 points on the periphery and center of the disc with a dial gauge, while rotating the disc.

Limit on disc deflection 0.1 mm (0.004 in.)

NOTICE:
Check front wheel bearing for looseness before measurement.

Figure 5-26 Disc Brake Inspection - B

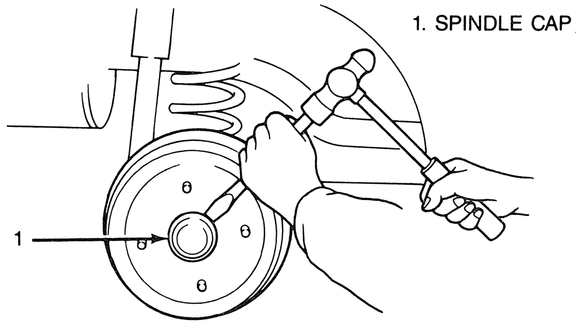
DRUM AND COMPONENTS R & I

1. REMOVE AND INSTALL BRAKE DRUM

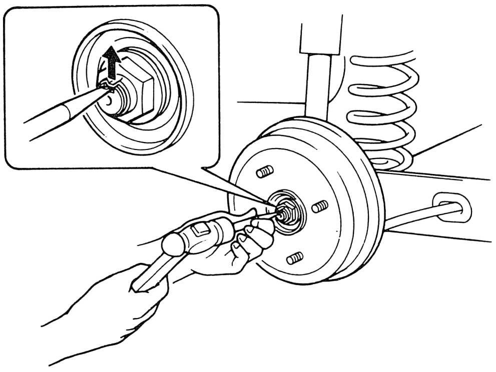
REMOVE OR DISCONNECT

1) Hoist car and remove wheel.

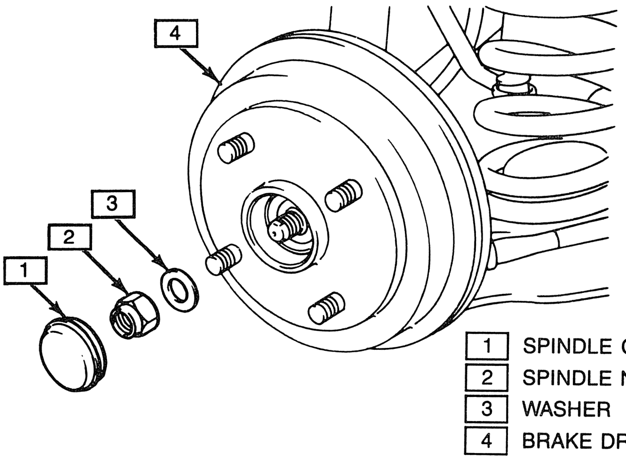
2) Remove spindle cap as shown (by hammering lightly at 3 locations around it so as not to deform or cause damage to seating part of cap).



3) Unfasten the staked portion on the nut with a chisel.



4) Remove castle nut and washer.



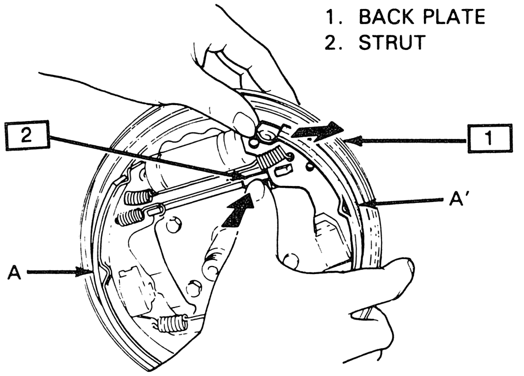
1 SPINDLE CAP
2 SPINDLE NUT
3 WASHER
4 BRAKE DRUM

INSTALL OR CONNECT

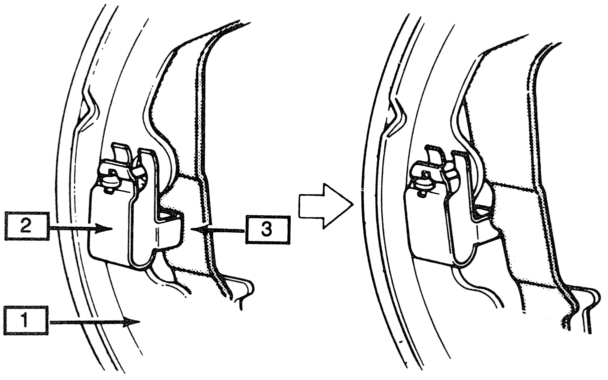
NOTICE:
See NOTICE at the beginning of this section.

1) To minimize the measurement of two shoes in A-A′ direction, push down strut towards back plate side (towards center of car) while pushing out one of shoes as shown.

NOTICE:
WHEN PUSHING SHOE, DO NOT CAUSE DAMAGE TO BOOTS.



2) Put brake shoe hold down spring back to its original position as shown. (Position shoe hold down spring on parking brake shoe lever so that shoe lever comes to the side of shoe hold down spring.)



1 BRAKE SHOE
2 SHOE HOLD DOWN SPRING
3 PARKING BRAKE SHOE LEVER

3) Install brake drum after making sure that the inside of brake drum and brake shoes are free from dirt and oil.

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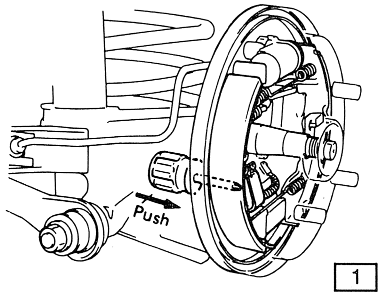
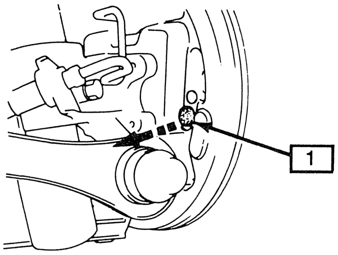
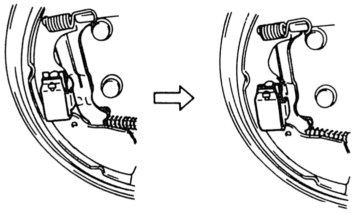
Figure 5-27 Drum R&I

4) Slacken parking brake cable by loosening its adjusting nuts, see PARKING BRAKE ADJUSTMENT.
5) Remove back plate plug attached to the back side of brake back plate to increase clearance between brake shoe and brake drum.
Insert a screwdriver into plug hole until its tip contacts shoe hold down spring and push driver in the arrow direction.
With this push, hold down spring is pushed up and releases parking shoe lever from hold down spring, resulting in larger clearance.

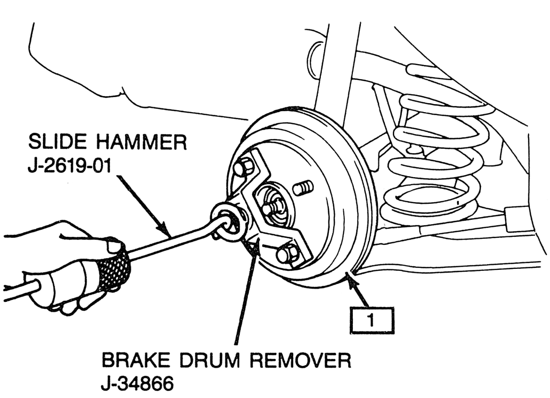


1 BACK PLATE PLUG





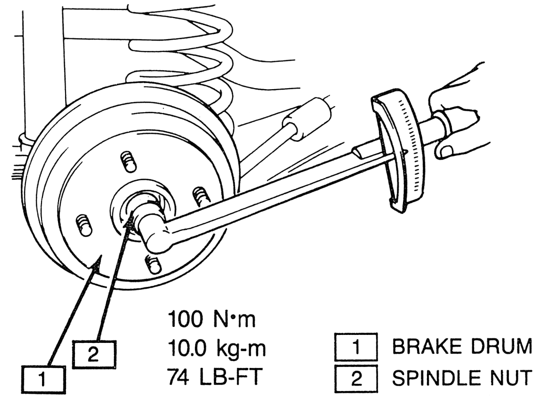
6) Pull brake drum off by using special tools.



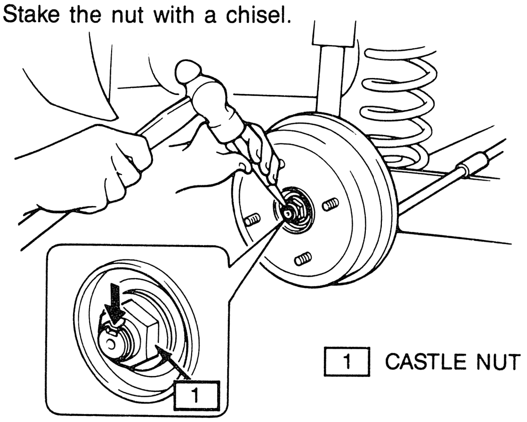
1 BRAKE DRUM

4) Torque castle nut to specification.

NOTICE:
Do not reuse the castle nut.
Replace it with a new one.



5) Stake the nut with a chisel.



6) Install spindle cap (when installing spindle cap, hammer lightly several locations on the collar of cap until the collar comes closely into contact with brake drum) and tighten wheel nuts to specified torque.

NOTICE:
If fitting part of cap is deformed or damaged or if it is fitted loosely, replace with new one.

Tightening torque for wheel nuts	N·m	kg-m	LB. FT.
	55	5.5	41

7) Upon completion of all jobs, depress brake pedal with about 30 kg (66 lbs.) load three to five times so as to obtain proper drum-to-shoe clearance and adjust parking brake.
8) Check to ensure that brake drum is free from dragging and proper braking is obtained. Then remove car from hoist and perform brake test.

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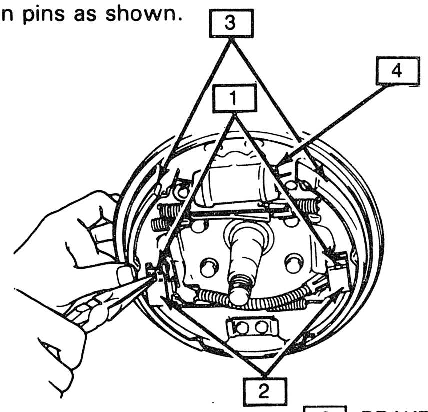
Figure 5-28 Drum R&I (Cont.)

2. REMOVE AND INSTALL BRAKE SHOE

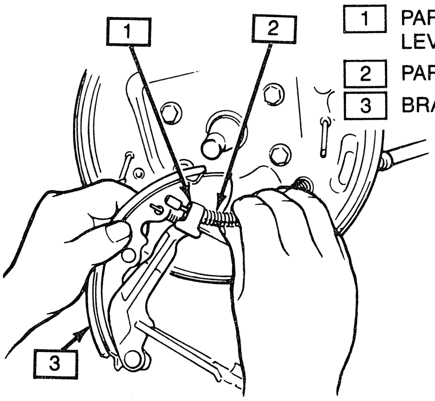
REMOVE OR DISCONNECT

1) Perform steps (1 – 7) of brake drum REMOVAL.
2) Remove shoe hold down springs by turning shoe hold down pins as shown.



1 SHOE HOLD DOWN PINS
2 SHOE HOLD DOWN SPRINGS
3 BRAKE SHOES
4 WHEEL CYLINDER

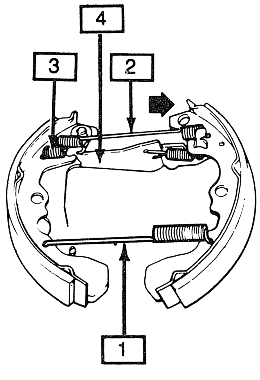
3) Disconnect parking brake cable from parking brake shoe lever and remove brake shoes.

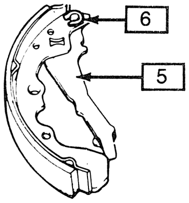


1 PARKING BRAKE SHOE LEVER
2 PARKING BRAKE CABLE
3 BRAKE SHOE

4) After removing spring indicated by 1 in the figure below, pull primary shoe on the right in the direction of arrow and from its rim remove strut and then return spring 2.
5) Remove spring 3 from strut and parking brake shoe lever from shoe rim.

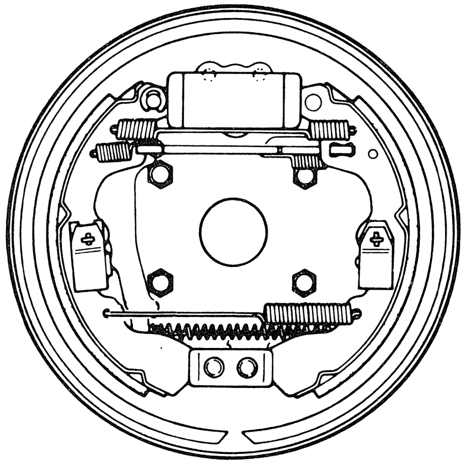
1 RETURN SPRING
2 RETURN SPRING
3 ANTIRATTLE SPRING
4 STRUT
5 PARKING BRAKE SHOE LEVER
6 RETAINER



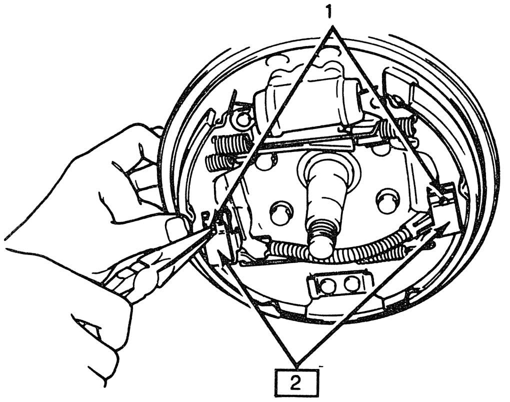


INSTALL OR CONNECT

1) Assemble parts as shown in the reverse order of removal.



2) Install shoe hold down springs by pushing them down in place and turning hold down pins.



1 SHOE HOLD DOWN PINS
2 SHOE HOLD DOWN SPRINGS

3) For procedure hereafter, refer to steps (1 – 9) of BRAKE DRUM INSTALLATION, Figure 5-27.

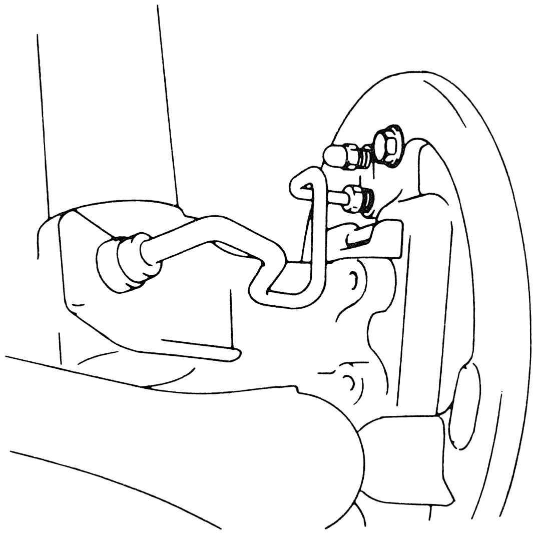
LC0014-5-M-RS

Figure 5-29 Brake Components R&I

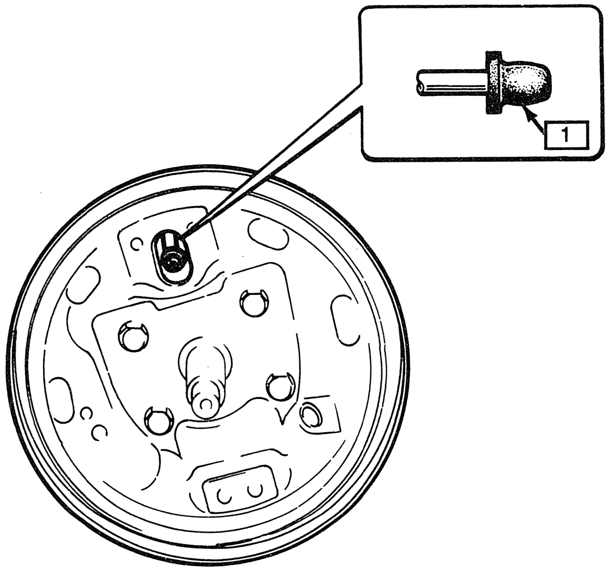
3. REMOVE AND INSTALL WHEEL CYLINDER

REMOVE OR DISCONNECT

1) Perfrom steps (1 – 7) of brake drum REMOVAL.
2) Perform steps (2 — 3) of brake shoe REMOVAL.
3) Remove bleeder screw.
4) Loosen brake pipe flare nut but only to the extent that fluid does not leak.



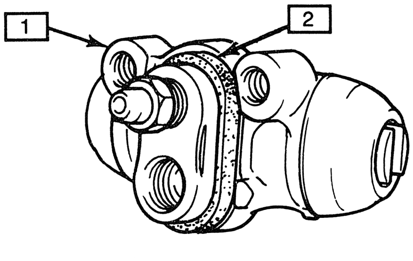
5) Remove wheel cylinder mounting bolts. Disconnect brake pipe from wheel cylinder and put wheel cylinder bleeder plug cap onto pipe to prevent fluid from spilling.



1 BLEEDER PLUG CAP

INSTALL OR CONNECT

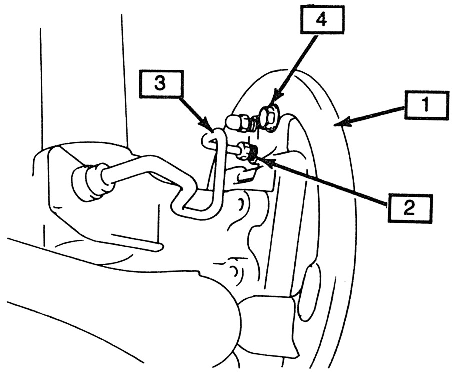
1) Install new gasket to wheel cylinder. Then take off bleeder plug cap from brake pipe and connect pipe to wheel cylinder just enough to prevent fluid from leaking.



1 WHEEL CYLINDER
2 GASKET

KC0519-5-M-RS

2) Tighten wheel cylinder to brake back plate to specified torque.
3) Torque flare nut of brake pipe which was connected in step 1 to specification.



1 BRAKE BACK PLATE
2 BRAKE PIPE FLARE NUT
14 - 18 N·m (1.4 - 1.8 kg-m, 10.5 - 13.0 LB-FT)
3 BRAKE PIPE
4 WHEEL CYLINDER BOLTS
10 - 13 N·m (1.0 - 1.3 kg-m, 7.5 - 9.0 LB-FT)

4) Install bleeder plug cap taken off pipe back to bleeder plug.
5) For procedure hereafter, refer to steps (1 — 3) of brake shoe INSTALLATION.

NOTICE:
Be sure to bleed brake system. (For bleeding operation, see BLEEDING BRAKES Fig. 5-13).

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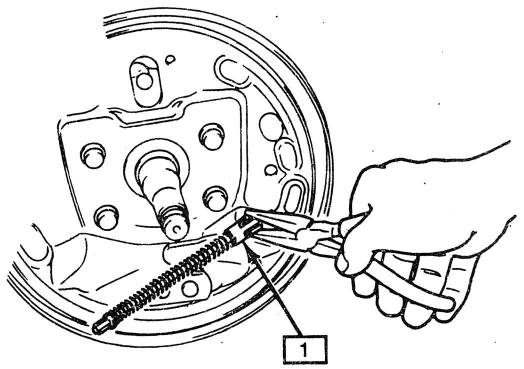
Figure 5-30 Wheel Cylinder R&I

4. REMOVE AND INSTALL BRAKE BACK PLATE

REMOVE OR DISCONNECT

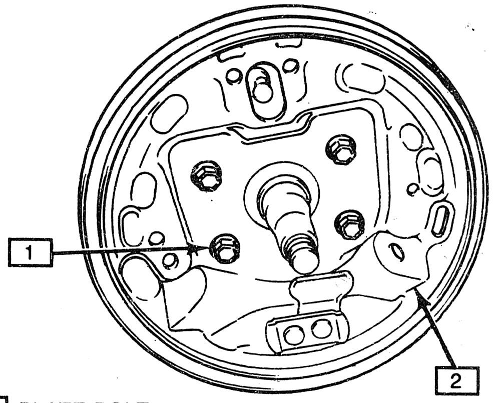
1) Perform steps (1 – 7) of brake drum REMOVAL.
2) Perform steps (2 and 3) of brake shoe REMOVAL.
3) Perform steps (3 and 4) of wheel cylinder REMOVAL.
4) Remove cable from brake back plate by squeezing parking brake cable stopper ring.



1 BRAKE CABLE STOPPER RING

KC0521-5-M-RS

5) Remove brake back plate from rear axle.



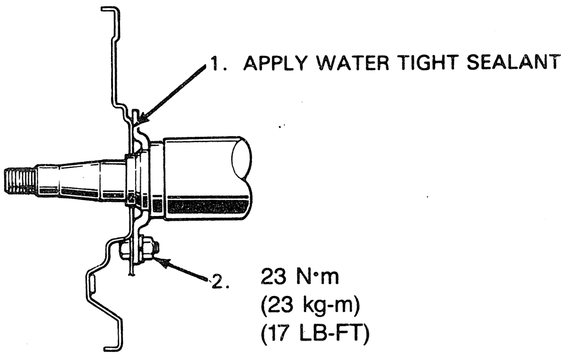
1 PLATE BOLT
2 BRAKE BACK PLATE

KC0522-5-M-RS

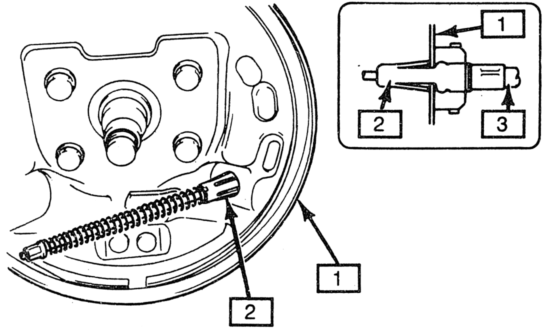
INSTALL OR CONNECT

1) Apply water-tight sealant to mating surfaces of brake back plate and rear axle, and torque back plate nuts to specification.

1. WATER TIGHT SEALANT
2. BACK PLATE NUTS



2) Install parking brake cable to brake back plate.



1 BRAKE BACK PLATE
2 CABLE STOPPER RING
3 BRAKE CABLE

KC0525-5-M-RS

3) Install wheel cylinder, and tighten wheel cylinder bolts and brake pipe flare nut to special torque.
4) For procedure hereafter, refer to steps (1-5) of WHEEL CYLINDER INSTALLATION.

NOTICE:
After assembling all parts, bleed brake system. (For bleeding operation, see BLEEDING BRAKES Fig. 5-13).

Figure 5-31 Brake Back Plate R&I

BRAKE DRUM AND COMPONENTS INSPECTION

1. INSPECT BRAKE DRUM

Inspect drum for cleanliness. Check wear of its braking surface by measuring its inside diameter.

Item	Standard	Service Limit
Brake drum ID	180 mm (7.09 in.)	182 mm (7.16 in.)

Whenever brake drums are removed, they should be thoroughly cleaned and inspected for cracks, scores, deep grooves.

Cracked, Scored, or Grooved Drum

A cracked drum is unsafe for further service and must be replaced. Do not attempt to weld a cracked drum.

Smooth up any slight scores. Heavy or extensive scoring will cause excessive brake lining wear and it will probably be necessary to resurface drum braking surface.

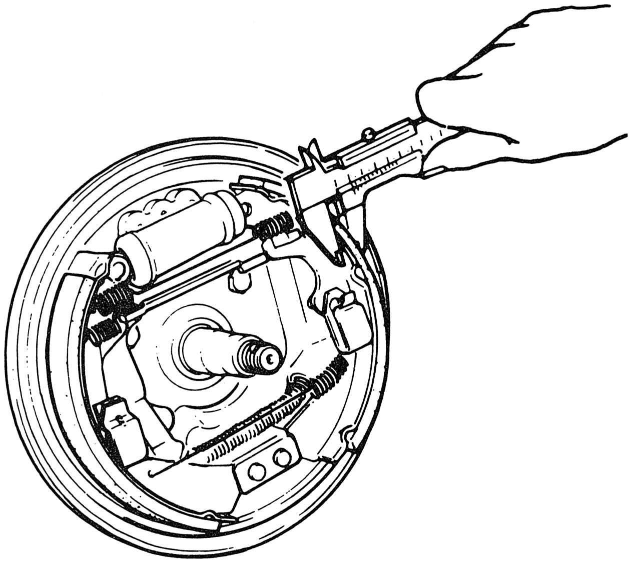
If brake linings are slightly worn and drum is grooved, drum should be polished with fine emery cloth but should not be turned.

NOTICE:
When drum is removed, visually inspect wheel cylinder for brake fluid leak. Correct leaky point, if any.

2. INSPECT BRAKE SHOE & LINING

Where lining is worn out beyond service limit, replace shoe.

Brake lining	Standard	Service limit
Thickness (lining + shoe rim)	6.1 mm (0.24 in.)	2.8 mm (0.11 in.)



If one of brake linings is worn to service limit, all linings must be replaced at the same time.

NOTICE:
Never polish lining with sandpaper. If lining is polished with sandpaper, hard particles of sandpaper will be deposited in lining and may damage drum. When it is required to correct lining, replace it with a new one.

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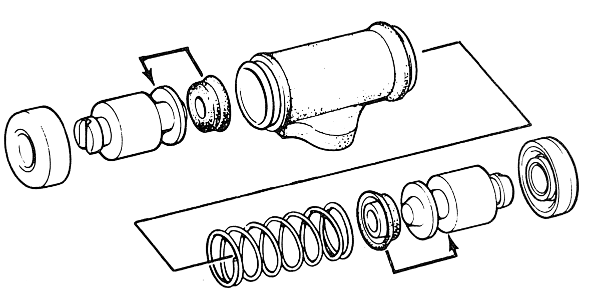
Figure 5-32 Inspection - A

3. INSPECT WHEEL CYLINDER

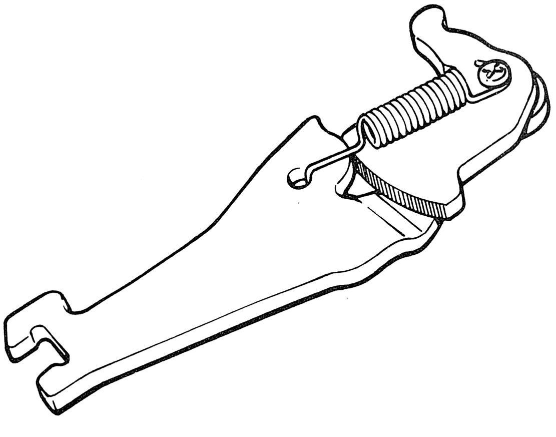
Inspect the wheel cylinder disassembled parts for wear, cracks, corrosion or damage.

NOTICE:
Clean wheel cylinder components with brake fluid.



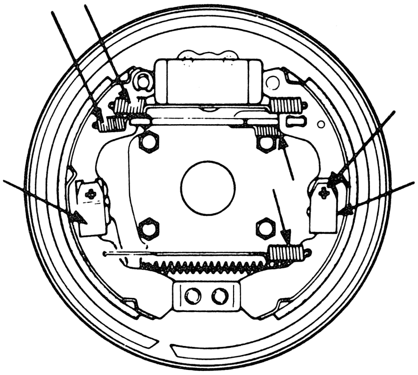
4. INSPECT BRAKE STRUT

Inspect ratchet of strut for wear or damage.



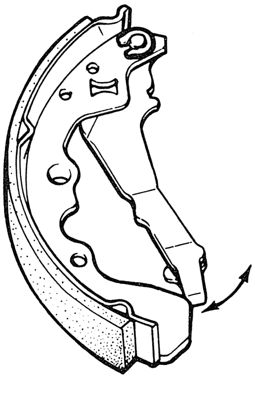
5. INSPECT SPRINGS

Inspect for damage or weakening.
Inspect each part with arrow for rust. If found defective, replace.



6. INSPECT PARKING SHOE LEVER

Inspect brake shoe lever for free movement against brake shoe web. If defective, correct or replace.



LC0017-5-M-RS

Figure 5-33 Inspection - B

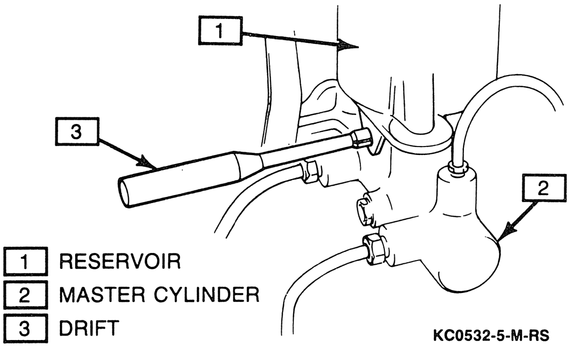
MASTER CYLINDER REPAIR

1. REMOVE AND INSTALL MASTER CYLINDER RESERVOIR

REMOVE OR DISCONNECT

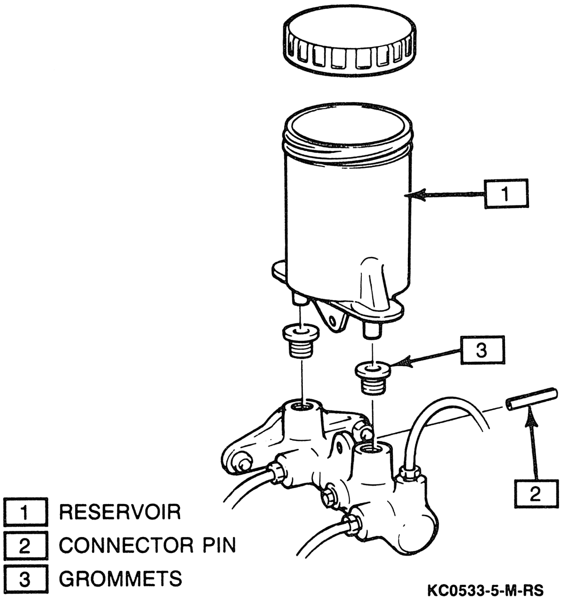
1) Disconnect reservoir lead wire from connector.
2) Clean outside of reservoir.
3) Take out fluid with a syringe.
4) Remove reservoir connector pin by using a drift.
5) Remove reservoir.

NOTICE:
DO NOT ALLOW BRAKE FLUID TO GET ON PAINTED SURFACES.



1 RESERVOIR
2 MASTER CYLINDER
3 DRIFT

KC0532-5-M-RS



1 RESERVOIR
2 CONNECTOR PIN
3 GROMMETS

KC0533-5-M-RS

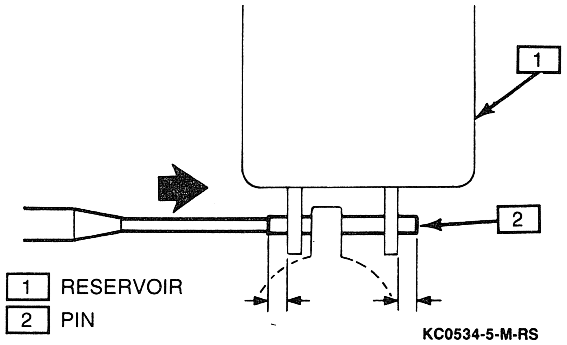
INSTALL OR CONNECT

NOTICE:
See NOTICE at the beginning of this section.

1) When using new grommets, lubricate them with brake fluid. Then press-fit grommets to master cylinder. Grommets must be seated in place.
2) Install reservoir and drive in reservoir pin.

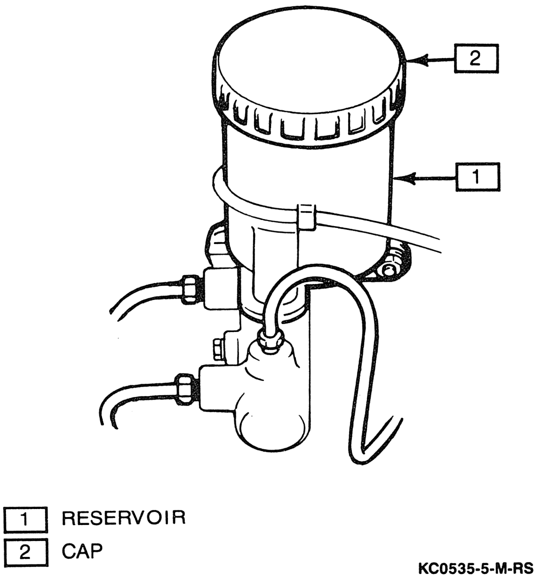
NOTICE:
Drive in reservoir pin until both of its ends at the right and left of reservoir become the same length.

3) Install reservoir lead wire.
4) Fill reservoir with specified fluid.
5) Upon completion of installation, check for fluid leakage.



1 RESERVOIR
2 PIN

KC0534-5-M-RS



1 RESERVOIR
2 CAP

KC0535-5-M-RS

Figure 5-34 Master Cylinder Repair - A

2. REMOVE AND INSTALL MASTER CYLINDER ASSEMBLY

REMOVE OR DISCONNECT

1) Disconnect reservoir lead at connector.
2) Clean around reservoir cap and take out fluid with a syringe.
3) Disconnect three brake pipes from master cylinder.

NOTICE:
Do not allow brake fluid to get on painted surfaces.

3) Remove two attaching nuts and washers.
4) Remove master cylinder as shown.

INSTALL OR CONNECT

NOTICE:

- **See NOTICE at the beginning of this section.**
- **Adjust clearance between booster piston rod and primary piston with special tool (See Fig. 5-43).**

1) Install master cylinder as shown and torque attaching nuts to specification.
2) Attach three hydraulic lines and torque flare nuts to specification.
3) Fill reservoir with specified brake fluid.
4) Connect reservoir lead wire.

After installing, check brake pedal height and bleed air from system.

1 RESERVOIR CAP
2 RESERVOIR
3 ATTACHING NUTS
4 FLARE NUTS
5 MASTER CYLINDER

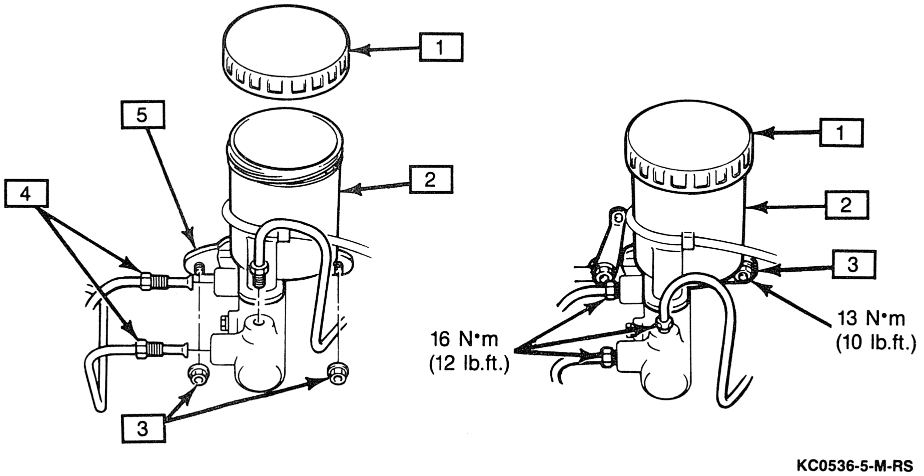
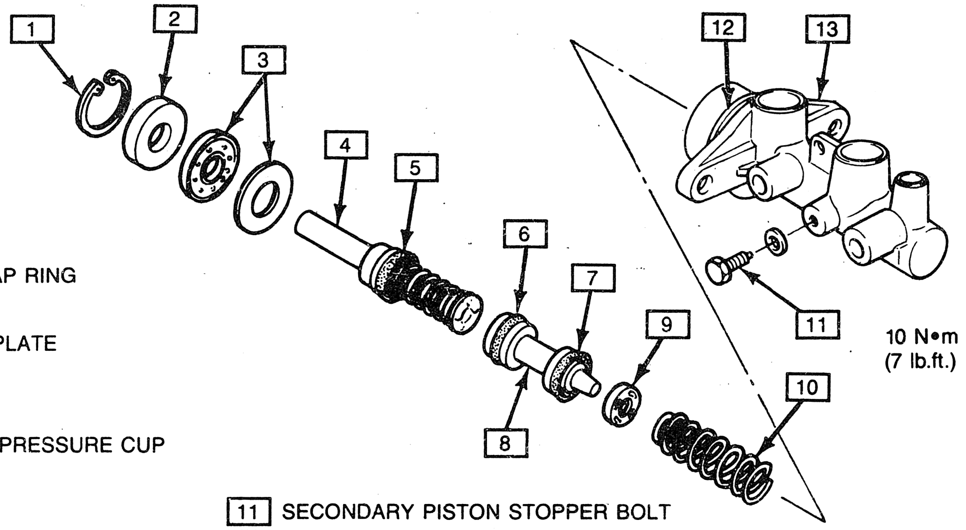


Figure 5-35 Master Cylinder Repair - B

3. DISASSEMBLE AND ASSEMBLE MASTER CYLINDER

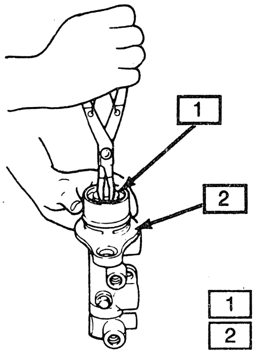


1	PISTON STOPPED SNAP RING
2	PISTON STOPPER
3	CYLINDER CUP AND PLATE
4	PRIMARY PISTON
5	PISTON CUP
6	SECONDARY PISTON PRESSURE CUP
7	PISTON CUP
8	SECONDARY PISTON
9	RETURN SPRING SECONDARY SEAT
10	SECONDARY PISTON RETURN SPRING
11	SECONDARY PISTON STOPPER BOLT
12	GASKET
13	MASTER CYLINDER BODY

KC0539-5-M-RS

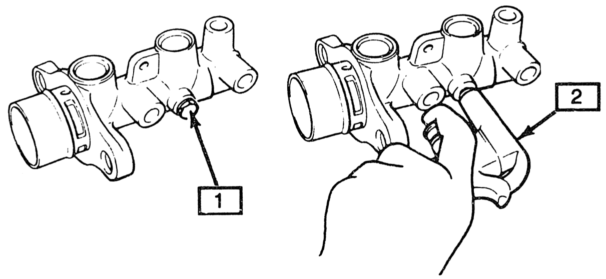
DISASSEMBLE

1) Remove circlip.
2) Remove primary piston by using compressed air as shown. Be cautious during removal as primary piston jumps out.



1	CIRCLIP
2	MASTER CYLINDER

3) Remove piston stopper bolt. Then remove secondary piston by blowing compressed air into hole from which piston stopper bolt was removed.



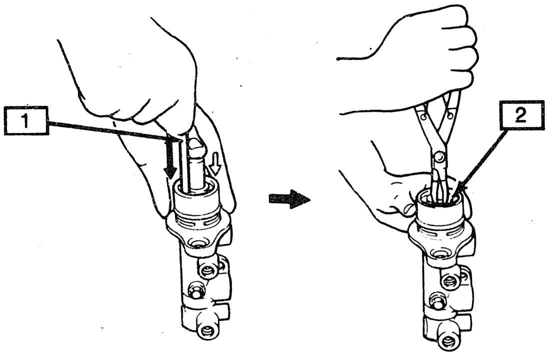
1	STOPPER BOLT
2	COMPRESSED AIR

ASSEMBLE

NOTICE:

- **See NOTICE at the beginning of this section.**
- **Before assembling, wash each part in brake fluid.**

1) Assemble secondary piston as shown below.
2) Install secondary piston assembly into cylinder.
3) Install primary piston in cylinder.
4) Depress, and install circlip.



1	ROD
2	CIRCLIP

5) Install piston stopper bolt with pistons pushed in all the way and tighten it to specified torque.
6) For installation on car, refer to INSTALLATION Fig. 5-35.

LC0018-5-M-RS

Figure 5-36 Master Cylinder Repair - C

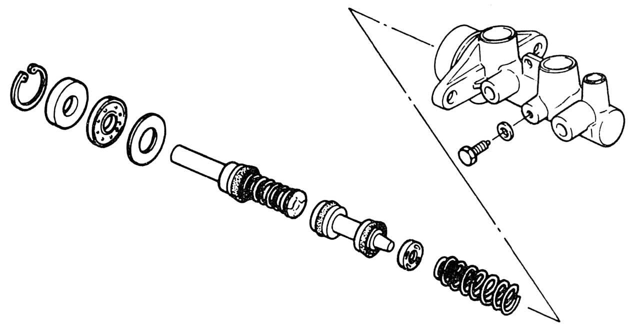
MASTER CYLINDER INSPECTION

INSPECTION MASTER CYLINDER

Inspect all disassembled parts for wear or damage, and replace parts if necessary.

NOTICE:

- **Wash disassembled parts with brake fluid.**
- **Do not reuse piston cups.**



KC0541-5-M-RS

Inspect master cylinder bore for scoring or corrosion. It is best to replace a corroded cylinder. Corrosion can be identified as pits or excessive roughness.

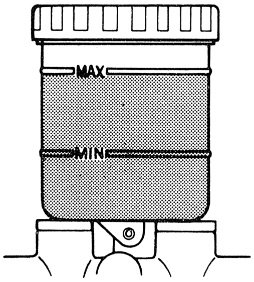
NOTICE:
Polishing the bore of the master cylinder with the cast aluminum body with anything abrasive is prohibited, as damage to the cylinder may occur.

Rinse cylinder in clean brake fluid. Shake excess rinsing fluid from cylinder. Do not use a cloth to dry cylinder, as lint from cloth cannot be kept from cylinder bore surfaces.

FILL RESERVOIR

NOTICE:
Do not use shock absorber fluid or any other fluid which contains mineral oil. Do not use a container which has been used for mineral oil or a container which is wet from water. Mineral oil will cause swelling and distortion of rubber parts in the hydraulic brake system and water will mix with brake fluid, lowering the fluid boiling point. Keep all fluid containers capped to prevent contamination.

Fluid to fill reservoir with is indicated on reservoir cap of the car with embossed letters or in owner's manual supplied with the car.
Add fluid up to MAX line.



KC0542-5-M-RS

Figure 5-37 Master Cylinder Inspection

BRAKE BOOSTER REPAIR

1. REMOVE AND INSTALL BOOSTER

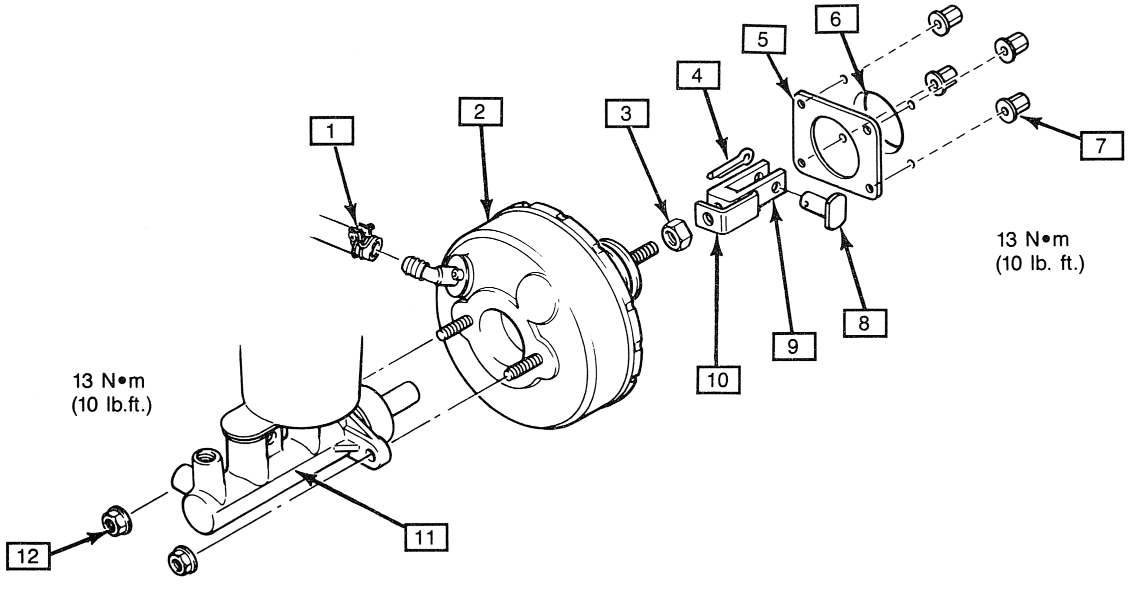
REMOVE OR DISCONNECT

1) Disconnect master cylinder from booster and disconnect push rod clevis from brake pedal arm.
2) Disconnect vacuum hose from booster.
3) Remove attaching nuts and remove booster as shown.

INSTALL OR CONNECT

NOTICE:
- **See NOTICE at the beginning of this section.**
- **Adjust clearance between booster piston rod and master cylinder piston with special tool. (See Fig. 5-43.)**
- **Check length of push rod clevis. (See Fig. 5-42.)**

1) Install booster to dash panel as shown. Then connect booster push rod clevis to pedal arm with pin and split pin.
2) Torque booster attaching nuts to specification.
3) Install master cylinder to booster and torque attaching nuts to specification.
4) Connect three brake pipes and torque flare nuts to specification.
5) Connect booster vacuum hose.
6) Connect reservoir lead wire at coupler.
7) Fill reservoir with specified fluid.
8) Bleed air from brake system
9) After installing, check pedal height and play.
10) Perform brake test and check each installed part for fluid leakage.



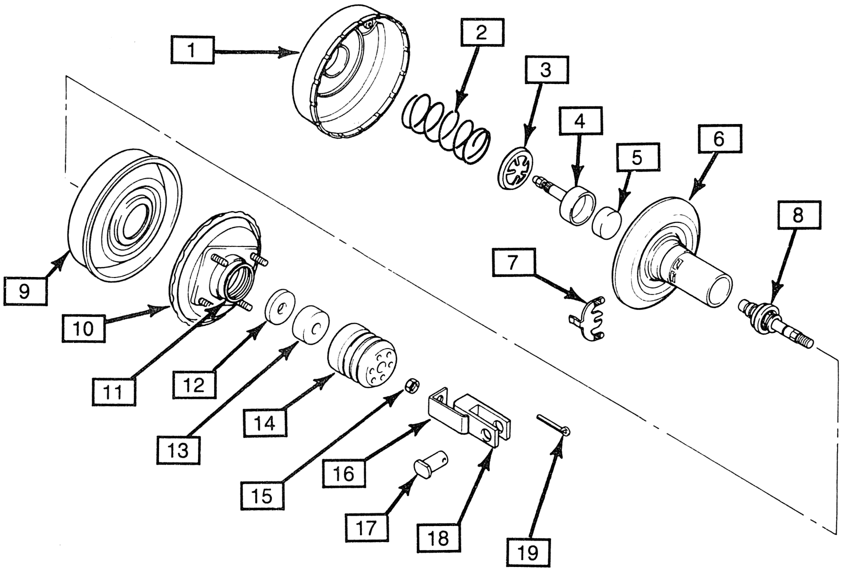
1	VACUUM HOSE	6	DASH PANEL	11	MASTER CYLINDER
2	BOOSTER	7	ATTACHING NUT	12	ATTACHING NUT
3	PUSH ROD CLEVIS LOCK NUT	8	CLEVIS PIN		
4	SPLIT PIN	9	PUSH ROD CLEVIS		
5	GASKET	10	PUSH ROD BRACKET		

KC0543-5-M-RS

Figure 5-38 Brake Booster Repair - A

2. DISASSEMBLY AND ASSEMBLY BOOSTER

1	BOOSTER NO. 1 BODY
2	BOOSTER PISTON RETURN SPRING
3	PISTON ROD RETAINER
4	PISTON ROD
5	REACTION DISC
6	BOOSTER PISTON
7	VALVE STOPPER KEY
8	BOOSTER AIR VALVE ASSEMBLY
9	DIAPHRAGM
10	BOOSTER NO. 2 BODY
11	NO. 2 BODY OIL SEAL
12	AIR CLEANER SEPARATOR
13	AIR CLEANER ELEMENT
14	BODY BOOT
15	NUT
16	BRACKET
17	MASTER CYLINDER CLEVIS PIN
18	PUSH ROD CLEVIS
19	SPLIT PIN


1
2
3
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5
6
7
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9
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11
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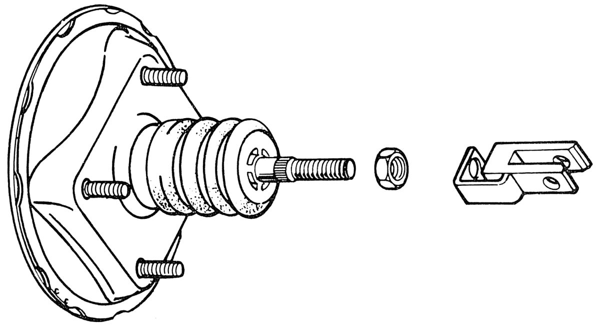
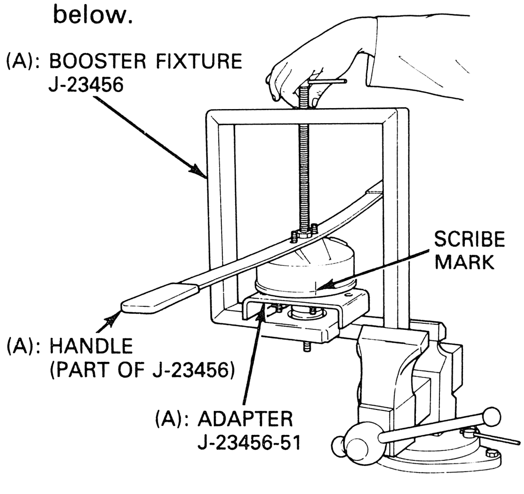
16
17
18
19
KC0544-5-M-RS

DISASSEMBLY

1) Remove piston rod from booster.
2) Remove push rod clevis and nut.



3) Attach booster to special tool (A) as shown below.


(A): BOOSTER FIXTURE J-23456
SCRIBE MARK
(A): HANDLE (PART OF J-23456)
(A): ADAPTER J-23456-51

4) Scribe a mark on the booster No. 1 and No. 2 body halves to facilitate assembly.
5) Tighten thumbscrew enough to allow for booster No. 1 body half rotation.

NOTICE:
Do not overtighten.

6) Turn special tool handle until No. 1 body projecting part and No. 2 body depressed part fit each other as shown below.

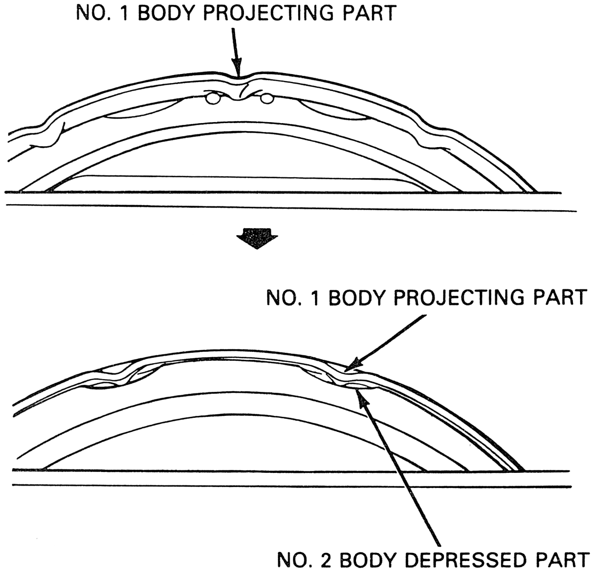

NO. 1 BODY PROJECTING PART
NO. 1 BODY PROJECTING PART
NO. 2 BODY DEPRESSED PART

Figure 5-39 Brake Booster Repair - B

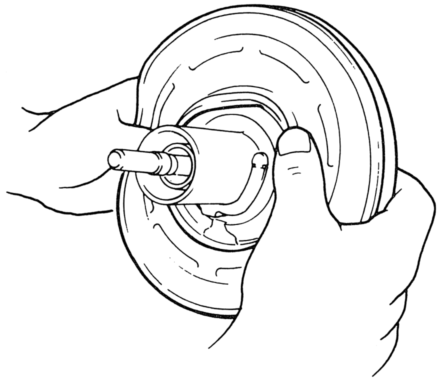
DISASSEMBLY (Cont.)

7) Release thumbscrew and separate No. 1 body and No. 2 body. Remove piston return spring.

NOTICE:
When separating two bodies, carefully hold both bodies to prevent either body from jumping off by spring force.

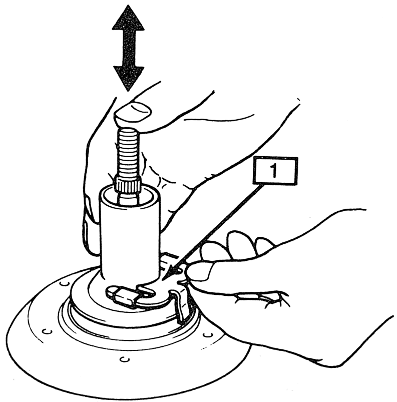
8) From booster No. 2 body, remove boot, air cleaner elements, air cleaner separator and booster piston in this order.
9) Remove diaphragm from booster piston.

NOTICE:
Do not use screwdriver or any other tool for removal. Pull it off by hand, carefully handling piston groove area where diaphragm is fitted.

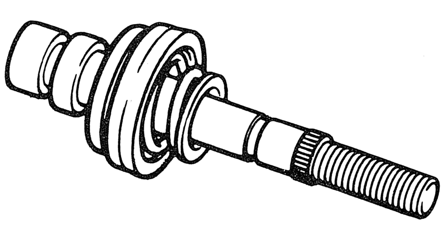


10) While compressing air valve spring (by moving rod up and down as shown), remove valve stopper key. Then remove booster air valve assembly from booster piston.

NOTICE:
Booster air valve assembly cannot be disassembled.

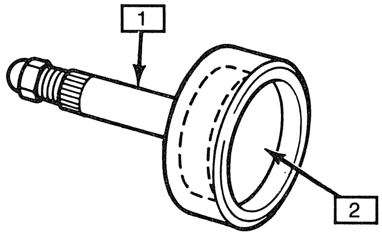

1
1 VALVE STOPPER KEY

BOOSTER AIR VALVE ASSEMBLY



KC0551-5-M-RS

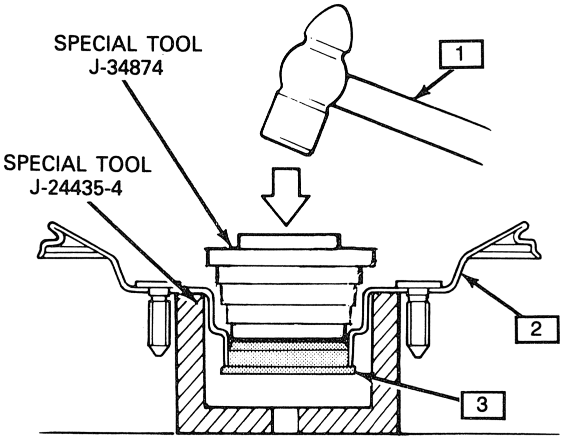
11) Remove reaction disc from booster piston with fingers.


1
2
1 PISTON ROD
2 REACTION DISC

KC0552-5-M-RS

12) Remove oil seal from booster No. 2 body with special tools as shown.

NOTICE:
Removed oil seal must not be reused.


SPECIAL TOOL J-34874
SPECIAL TOOL J-24435-4
1
2
3
1 HAMMER LIGHTLY
2 NO. 2 BODY
3 OIL SEAL

LC0019-5-M-RS

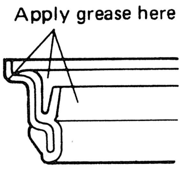
Figure 5-40 Brake Booster Repair - C

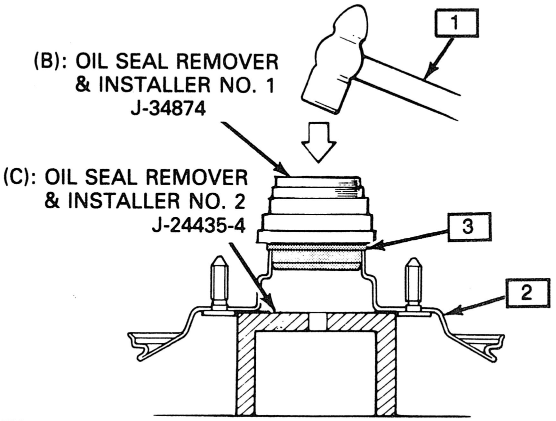
ASSEMBLY

NOTICE:

- **See NOTICE at the beginning of this section.**
- **Be sure to use silicone grease wherever application of grease is instructed during assembly. Use of oil and grease for installation of check valve and its grommet is strictly prohibited.**

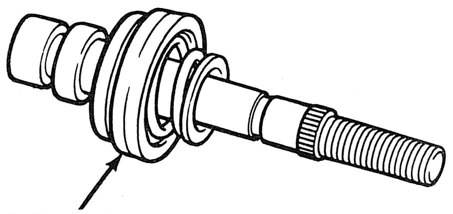
1) Apply silicone grease to oil seal outer surface and oil seal lip as shown.
Press-fit oil seal to booster No. 2 body by using special tools (B) and (C).





1 HAMMER
2 NO. 2 BODY
3 OIL SEAL

2) Install booster air valve assembly to booster piston. Before installation, apply silicone grease as shown.

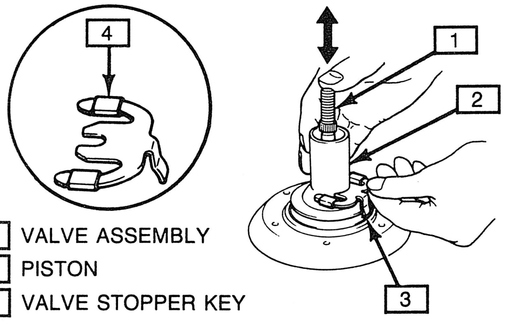

SLIDING SURFACE AGAINST PISTON
(SEALED SURFACE)

KC0555-5-M-RS

3) Compress air valve assembly and insert valve stopper key.

NOTICE:

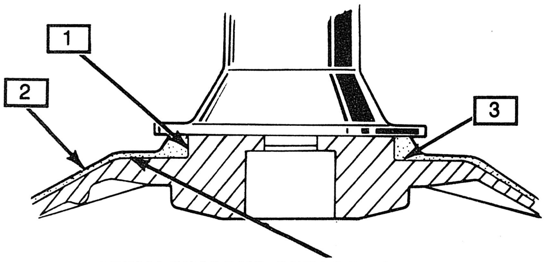
- **Be sure that valve assembly is in piston "A" as indicated in figure. (Do not force installation.)**
- **Pay attention to installing direction of valve stopper key.**



1 VALVE ASSEMBLY
2 PISTON
3 VALVE STOPPER KEY
4 KEY CUSHION

4) Install diaphragm to booster piston by hand.

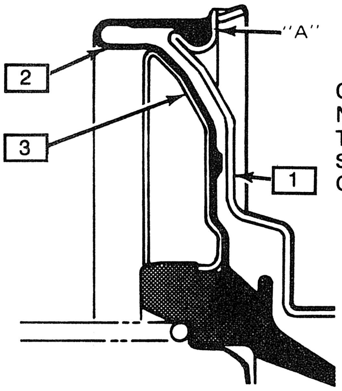
NOTICE:
Check to be sure that diaphragm is seated securely in piston groove for diaphragm by turning diaphragm.



APPLY SILICONE GREASE TO ENTIRE MATING SURFACES OF PISTON AND DIAPHRAGM.

1 GROOVE
2 DIAPHRAGM
3 BOOSTER PISTON

5) Install reaction disc to booster piston after greasing its entire face.
6) Install booster piston to booster No. 2 body.



CHECK ALL AROUND BOOSTER NO. 2 BODY TO MAKE SURE THAT DIAPHRAGM IS SEATED SECURELY IN ITS OUTER GROOVE AS SHOWN IN "A".

1 BOOSTER NO. 2 BODY
2 DIAPHRAGM
3 BOOSTER PISTON

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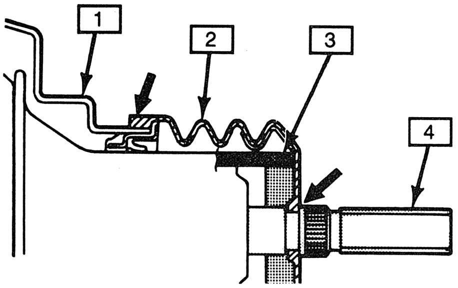
Figure 5-41 Brake Booster Repair - D

ASSEMBLY (Cont.)

7) Install air cleaner separator and then two elements to rod of air valve assembly.

8) Install body boot to booster No. 2 body. Both ends of boot must be fitted securely as shown.



1	NO. 2 BODY
2	BOOT
3	BOOSTER PISTON
4	ROD

9) Place No. 2 body on special tool. Then install piston return spring into piston spring guide.

10) Place booster No. 1 body on piston return spring.

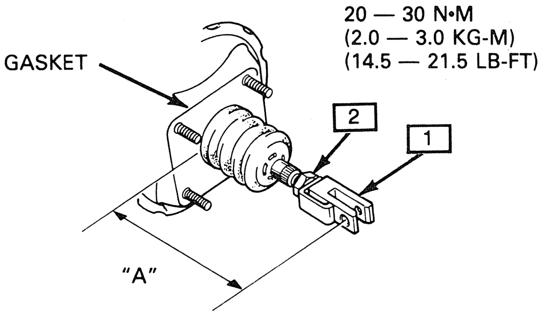
11) Place special tool handle on No. 1 body and tighten thumbscrew as shown in (A) of Disassembly.

12) Rotate special tool and line up scribe marks made at disassembly.

NOTICE:
When assembling body halves, use care so that the diaphragm is not caught by the projections at the 12 locations around No. 1 body. Make sure body halves mate squarely before rotating tool. Do not overtighten thumbscrew.

13) Install push rod clevis so that below measurement "A" is obtained and torque nut to specification.

NOTICE:
Dimension 'A' does not include thickness of gasket.



114.5–115.5 mm
(4.51–4.54 in.)

1	CLEVIS
2	NUT

14) Remove booster from special tool and insert piston rod into booster piston.

NOTICE:
Whenever booster is disassembled, make sure to check clearance between piston rod and master cylinder piston after reassembly. (For details, refer to Fig. 5-43.)

15) For installation of booster, see steps 1 — 3 of INSTALLATION (Fig. 5-38.)

LC0021-5-M-RS

Figure 5-42 Brake Booster Repair - E

BRAKE BOOSTER INSPECTION OR ADJUSTMENT

1. INSPECT BOOSTER INNER PARTS

NOTICE:
After disassembly, soak all metal parts in ethyl alcohol. Wipe rubber diaphragm and plastic parts with a clean cloth. Use ethyl alcohol dampened cloth to wipe out heavy dirt. Application of ethyl alcohol especially to rubber parts is prohibited.

RUBBER PARTS

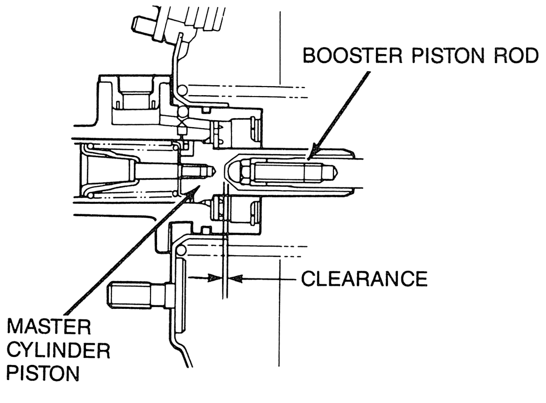
Wipe fluid from the rubber parts and carefully inspect each rubber part for cuts, nicks or other damage. These parts are the key to the control of airflow. If there is any question as to the serviceability of rubber parts, REPLACE them.

METAL PARTS

BADLY DAMAGED ITEMS, OR THOSE WHICH WOULD TAKE EXTENSIVE WORK OR TIME TO REPAIR, SHOULD BE REPLACED. IN CASE OF DOUBT, INSTALL NEW PARTS.

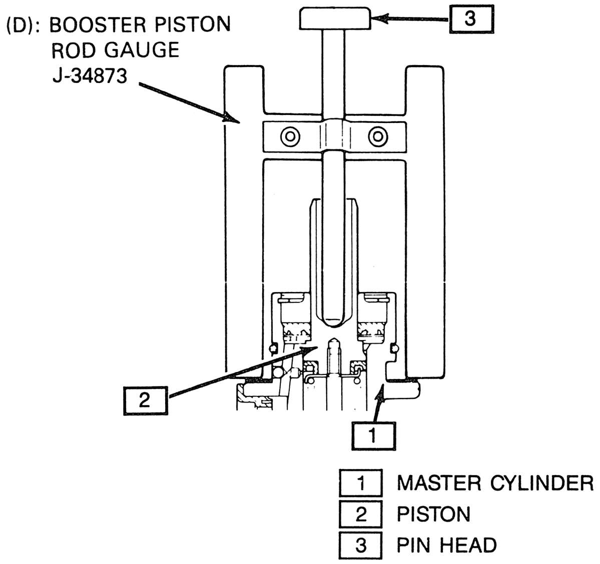
2. INSPECT/ADJUST CLEARANCE BETWEEN BOOSTER PISTON ROD AND MASTER CYLINDER PISTON

The length of the booster piston rod is adjusted to provide the specified clearance between the piston rod end and the master cylinder piston.

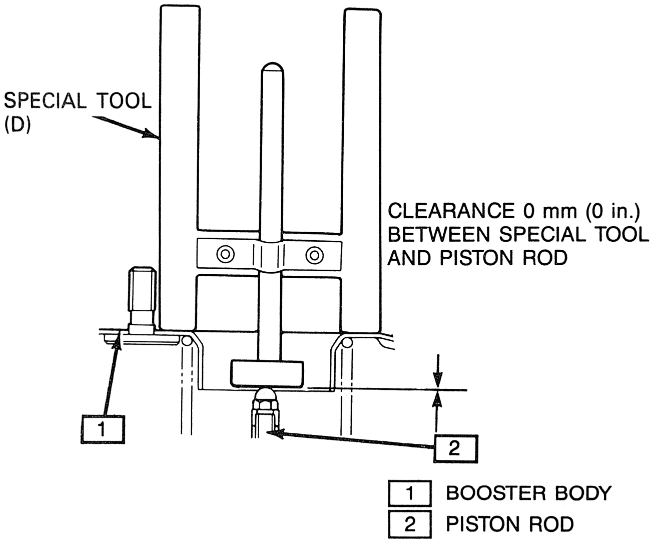

BOOSTER PISTON ROD
CLEARANCE
MASTER CYLINDER PISTON

- Before measuring clearance, push piston rod several times so as to make sure reaction disc is in place.
- Take measurement with gasket installed to master cylinder.
- Keep inside of booster at atmospheric pressure for measurement.

1) Set the special tool (D) on master cylinder and push pin until it contacts the piston.


(D): BOOSTER PISTON ROD GAUGE J-34873
3
2
1
1 MASTER CYLINDER
2 PISTON
3 PIN HEAD

2) Turn special tool upside down and place it on booster. Adjust booster piston rod length until rod end contacts pin head.
3) Adjust clearance by turning adjusting bolt of piston rod.


SPECIAL TOOL (D)
CLEARANCE 0 mm (0 in.) BETWEEN SPECIAL TOOL AND PISTON ROD
1
2
1 BOOSTER BODY
2 PISTON ROD

REFERENCE

When adjusted as above, if negative pressure is applied to booster with engine at idle, piston to piston rod clearance should become 0.1 — 0.5 mm (0.004 — 0.020 in).

LC0022-5-M-RS

Figure 5-43 Brake Booster Inspection or Adjustment - A

3. INSPECT BOOSTER OPERATION

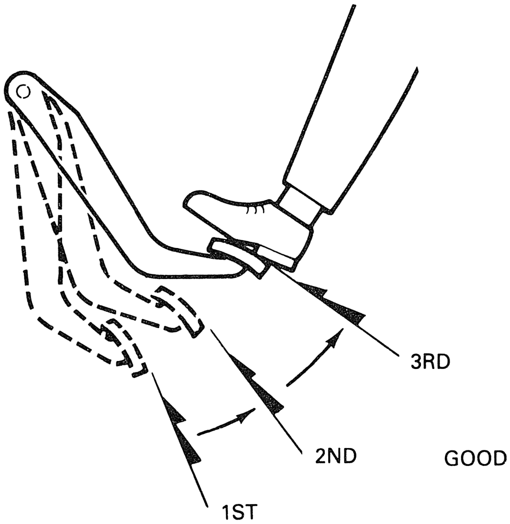
There are two ways to perform this inspection; with and without a tester. Ordinarily, it is possible to roughly determine its condition without using a tester.

NOTICE:
For this check, make sure that no air is in hydraulic line.

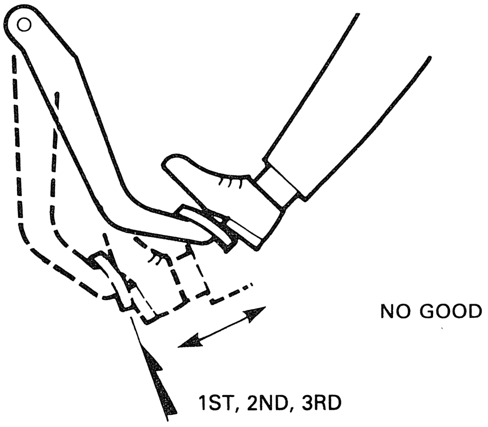
INSPECTION WITHOUT TESTER

Check air tightness.

1) Start engine.
2) Stop engine after running for 1 or 2 minutes.
3) Depress brake pedal several times with the same load as in ordinary braking and observe pedal travel. If pedal goes down deep the first time but its travel decreases as it is depressed the second and more times, air tightness is obtained.



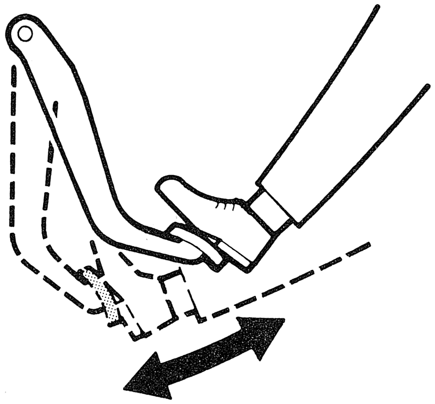
4 If pedal travel does not change, air tightness is not obtained.



NOTICE:
If defective, inspect vacuum lines and sealing parts, and replace any faulty part.
When this has been done, repeat the entire test!

Check operation

1) With engine stopped, depress brake pedal several times with the same load and make sure that pedal travel does not change.



2) Start engine while depressing brake pedal. If pedal travel increases a little, operation is satisfactory. No change in pedal travel indicates malfunction.

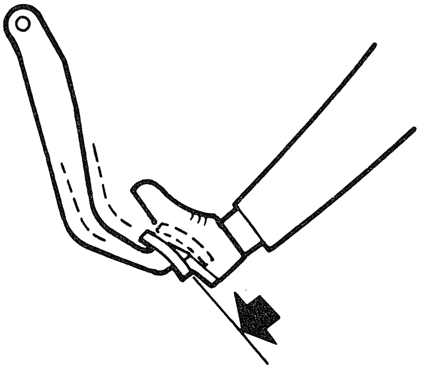


Figure 5-44 Brake Booster Inspection or Adjustment - B

Check air tightness under load

1) With engine running, depress brake pedal. Then stop engine while holding brake pedal depressed.

2) Hold brake depressed for 30 seconds. If pedal height does not change, condition is good. But it isn't if pedal rises.

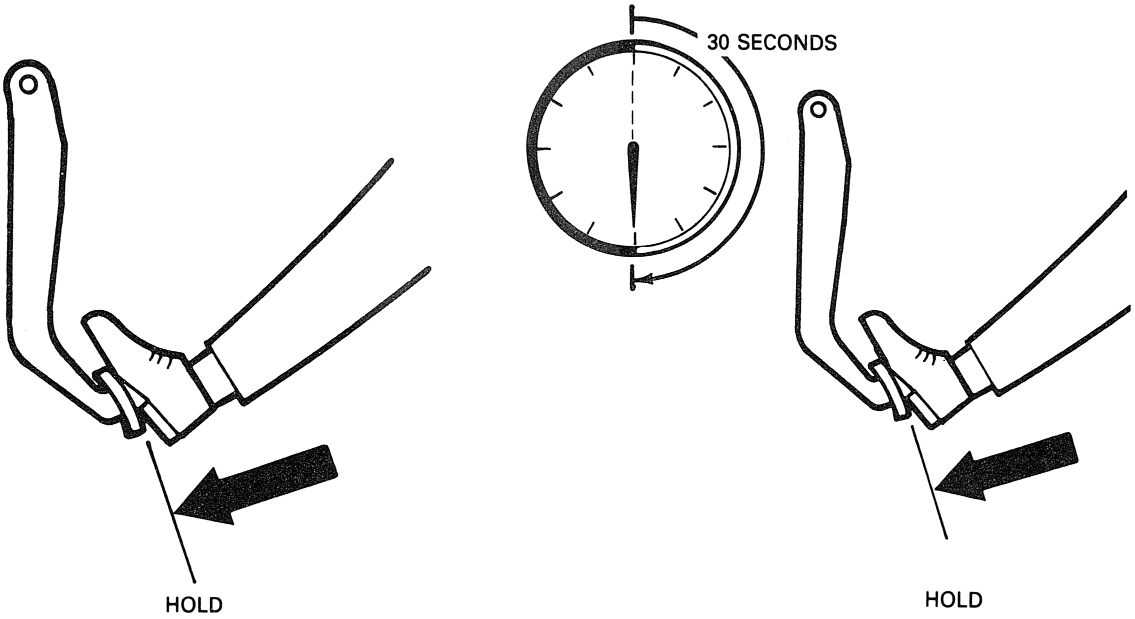


Figure 5-45 Brake Booster Inspection or Adjustment - B (Cont.)

BOOSTER INSPECTION TABLE

Part	Inspect For	Corrective Action
1. Booster piston	Cracks, distortion or damage.	Replace.
2. Air valve assembly (Control valve and spring)	Damaged or worn seal surfaces.	Replace.
3. Reaction disc	Damage or wear.	Replace.
4. Diaphragm, boot, and rubber	Damage.	Replace.
5. Piston rod and retainer	Damage or bend.	Replace.
6. Booster No. 1 & No. 2 body	1. Scratches, scores, pits, dents, or other damage affecting rolling or sealing of diaphragm or other seals. 2. Cracks, damage at ears, damaged threads on studs. 3. Bent or nicked locking lugs. 4. Loose studs.	Replace, unless easily repaired. Replace, unless easily repaired. Replace, unless easily repaired. Replace.
7. Air filters and separator	Dirt.	Replace.

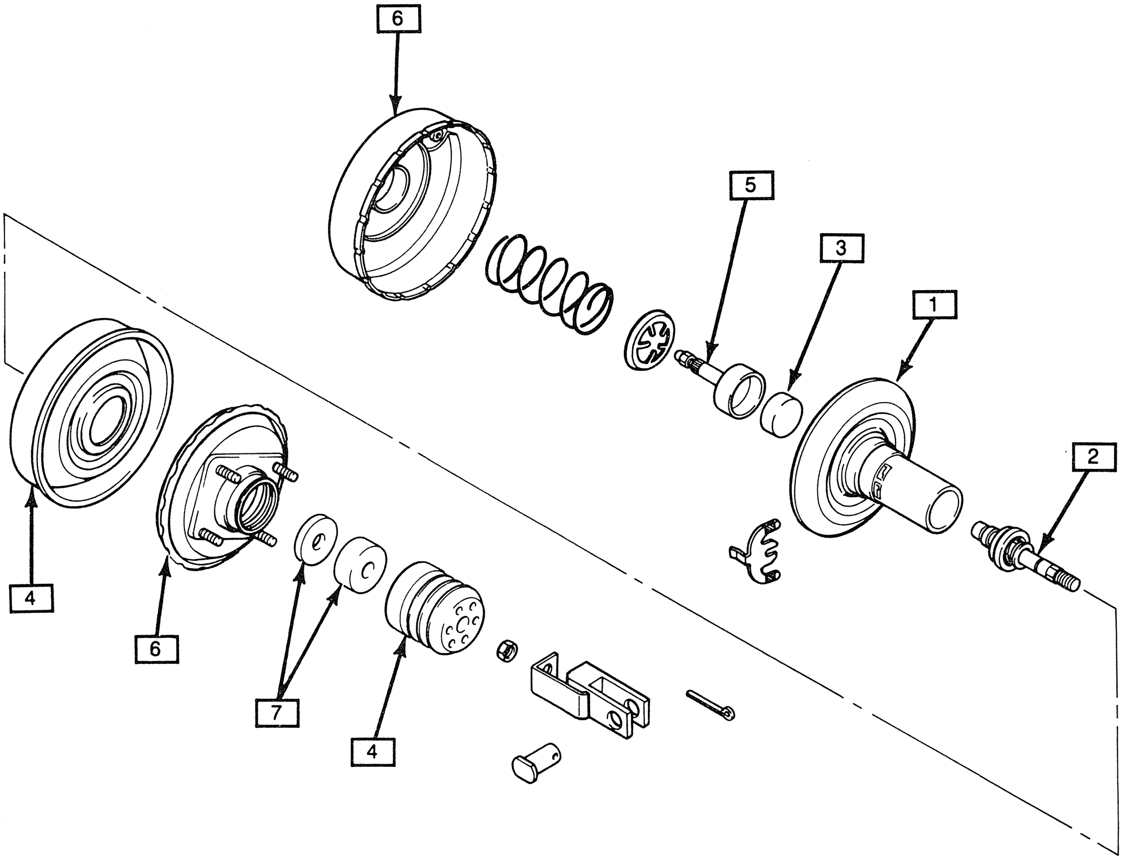
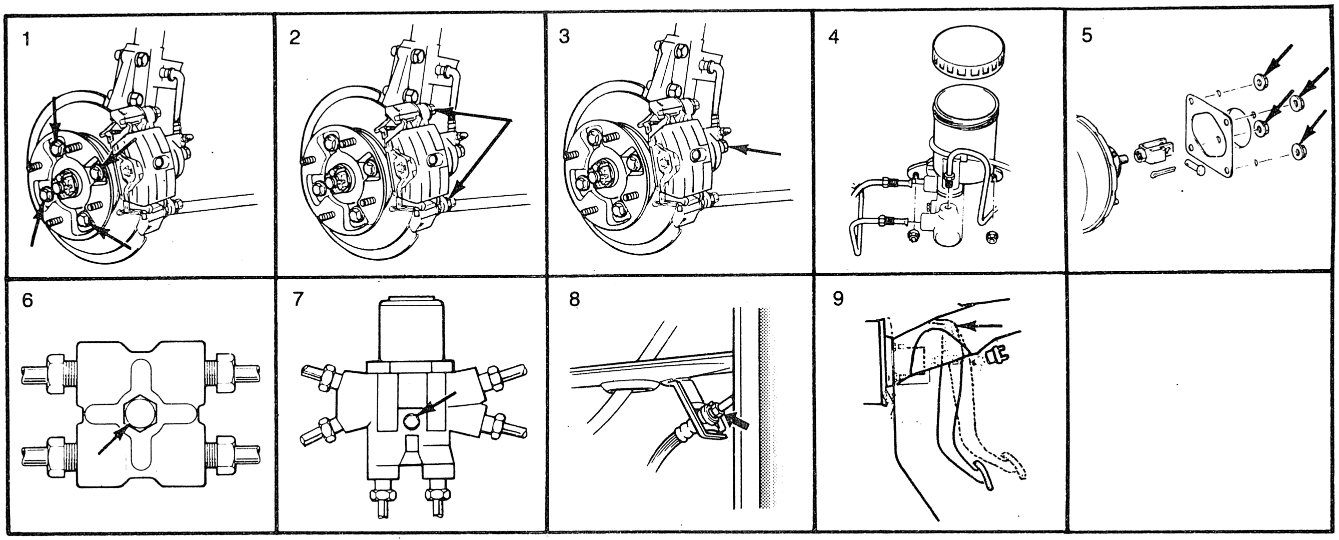


Figure 5-46 Booster Inspection Table

RECOMMENDED TORQUE SPECIFICATIONS

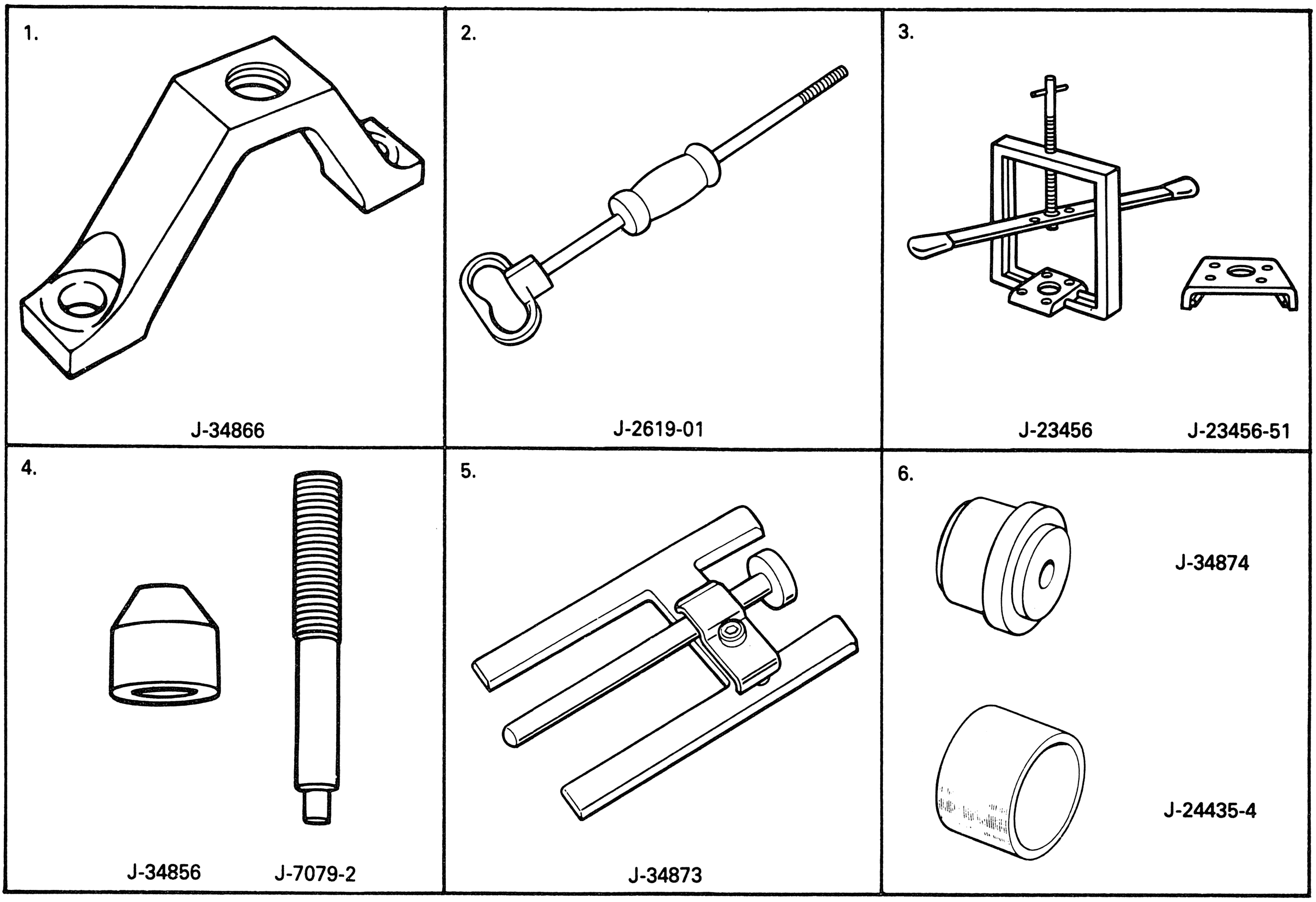
Fastening Parts	Tightening Torque		
	N·m	kg-m	LB-FT
1. Brake disc bolt	50	5.0	37
2. Brake caliper bolt	30	3.0	22
3. Front brake flexible hose bolt	23	2.3	17
4. Master cylinder nut	13	1.3	10
5. Booster nut	13	1.3	10
6. Brake pipe 4-way joint bolt	10	1.0	7
7. Proportioning valve bolt	10	1.0	7
8. Brake flare nut	16	1.6	12
9. Brake pedal shaft nut	23	2.0	17
10. Drive shaft castle nut	210	21.0	155
11. Rear axle castle nut	100	10.0	73
12. Rear Brake Nut (Brake back plate nut)	23	2.3	17



REQUIRED SERVICE MATERIALS

Materials	Use
Brake fluid	● To fill master cylinder reservoir. ● To clean and apply to inner parts of master cylinder, caliper and wheel cylinder when they are disassembled.
Silicone grease	● To apply to brake booster inner parts where application is instructed in this manual.
Watertight sealant	● To apply to mating surfaces of brake back plate and rear axle. ● To apply to mating surfaces of brake back plate and parking brake cable.

Figure 5-47 Torque Specifications


1.
J-34866
2.
J-2619-01
3.
J-23456
J-23456-51
4.
J-34856
J-7079-2
5.
J-34873
6.
J-34874
J-24435-4

No.	Tool Name	Tool No.
1.	Brake drum and front wheel hub remover	J-34866
2.	Slide hammer	J-2619-01
3.	Booster separating fixture Booster separating fixture adapter	J-23456 J-23456-51
4.	Wheel hub installer Driver handle (non-threaded)	J-34856 J-7079-2
5.	Booster piston rod gauge	J-34873
6.	Booster body oil seal remover and installer	J-34874/J-24435-4

Figure 5-48 Special Tools

SECTION 6

ENGINE

CONTENTS

GENERAL INFORMATION 6-1
Engine Diagnosis 6-3
Compression Check 6-12
Engine Vacuum Check 6-13
ENGINE MECHANICAL 6A1-1
ENGINE COOLING 6B-1
ENGINE FUEL 6C-1
ENGINE ELECTRICAL 6D-1
ENGINE EMISSION CONTROLS 6E12-1
ENGINE EXHAUST 6F-1

ALL NEW GENERAL MOTORS VEHICLES ARE CERTIFIED BY THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY AS CONFORMING TO THE REQUIREMENTS OF THE REGULATIONS FOR THE CONTROL OF AIR POLLUTION FROM NEW MOTOR VEHICLES. THIS CERTIFICATION IS CONTINGENT ON CERTAIN ADJUSTMENTS BEING SET TO FACTORY STANDARDS. IN MOST CASES, THESE ADJUSTMENT POINTS EITHER HAVE BEEN PERMANENTLY SEALED AND/OR MADE INACCESSIBLE TO PREVENT INDISCRIMINATE OR ROUTINE ADJUSTMENT IN THE FIELD. FOR THIS REASON, THE FACTORY PROCEDURE FOR TEMPORARILY REMOVING PLUGS, CAPS, ETC., FOR PURPOSES OF SERVICING THE PRODUCT MUST BE STRICTLY FOLLOWED AND, WHEREVER PRACTICAL, RETURNED TO THE ORIGINAL INTENT OF THE DESIGN.

GENERAL INFORMATION

STATEMENT ON CLEANLINESS AND CARE

An automobile engine is a combination of many machined, honed, polished, and lapped surfaces with tolerances that are measured in the thousandths of a millimeter (ten thousandths of an inch). Accordingly, when any internal engine parts are serviced, care and cleanliness are important. Throughout this section, it should be understood that proper cleaning and protection of machined surfaces and friction areas are part of the repair procedure. This is considered standard shop practice even if not specifically stated.

- A liberal coating of engine oil should be applied to friction areas during assembly to protect and lubricate the surfaces on initial operation.
- Whenever valve train components, pistons, piston rings, connecting rods, rod bearings, and crankshaft journal bearings are removed for service, they should be returned in order. At the time of installation, they should be installed in the same locations and with the same mating surfaces as when removed.
- Battery cables should be disconnected before any major work is performed on the engine. Failure to disconnect cables may result in damage to wiring harness or other electrical parts.
- Throughout this manual, the three cylinders of the engine are identified by numbers - No. 1, No. 2 and No. 3 as counted from crankshaft pulley side to flywheel side (Figure 1).

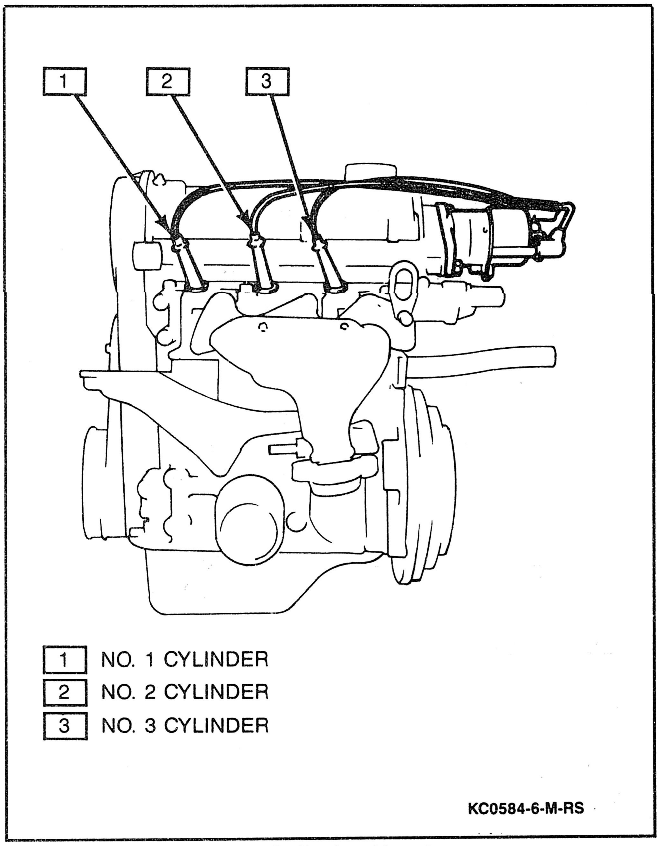


Figure 1 Cylinder Numbers

GENERAL INFORMATION ON ENGINE SERVICE

NOTICE: The following information on engine service should be noted carefully, as it is important in preventing damage and in contributing to reliable engine performance.

- When raising or supporting the engine for any reason, do not use a jack under the oil pan. Due to the small clearance between the oil pan and oil pump strainer, jacking against the oil pan may cause it to be bent against the oil pick-up unit.
- It should be kept in mind, while working on the engine, that the 12-volt electrical system is capable of violent and damaging short circuits. When performing any work where electrical terminals could possibly be grounded, the ground cable of the battery should be disconnected at the battery.

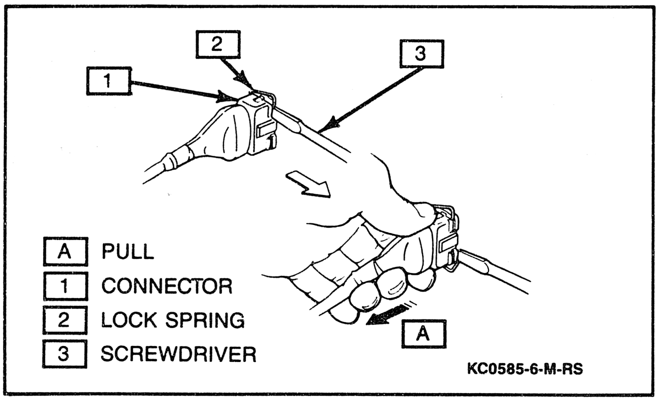


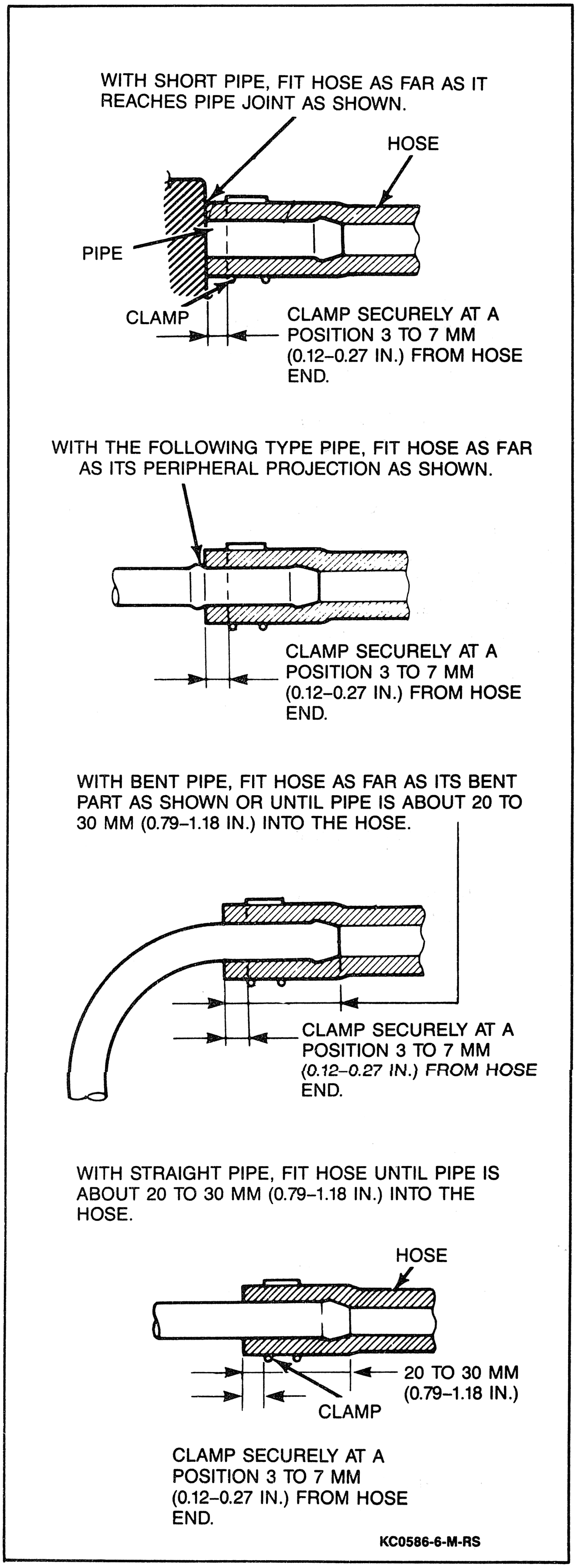
Figure 2 Spring Lock Connector Disconnection

- Any time the throttle body or air cleaner is removed, the intake opening should be covered. This will protect against accidental entrance of foreign material which could follow the intake passage into the cylinder and cause extensive damage when the engine is started.
- When disconnecting connectors do not pull wiring harness but make sure to hold connector itself. Be sure to unlock the lock before disconnection with spring lock type connector. Remove spring before disconnecting. Do not deform spring (Figure 2).

NOTICE: Do not disconnect connector without unlocking. Damage to connector may result.

All Fuel Injected Engines

CAUTION: To reduce the risk of fire and personal injury, it is necesary to relieve the fuel system pressure before servicing fuel system components.


WITH SHORT PIPE, FIT HOSE AS FAR AS IT REACHES PIPE JOINT AS SHOWN.

CLAMP SECURELY AT A POSITION 3 TO 7 MM (0.12–0.27 IN.) FROM HOSE END.

WITH THE FOLLOWING TYPE PIPE, FIT HOSE AS FAR AS ITS PERIPHERAL PROJECTION AS SHOWN.

CLAMP SECURELY AT A POSITION 3 TO 7 MM (0.12–0.27 IN.) FROM HOSE END.

WITH BENT PIPE, FIT HOSE AS FAR AS ITS BENT PART AS SHOWN OR UNTIL PIPE IS ABOUT 20 TO 30 MM (0.79–1.18 IN.) INTO THE HOSE.

CLAMP SECURELY AT A POSITION 3 TO 7 MM *(0.12–0.27 IN.) FROM HOSE* END.

WITH STRAIGHT PIPE, FIT HOSE UNTIL PIPE IS ABOUT 20 TO 30 MM (0.79–1.18 IN.) INTO THE HOSE.

CLAMP SECURELY AT A POSITION 3 TO 7 MM (0.12–0.27 IN.) FROM HOSE END.

Figure 3 Hose Connections

ENGINE DIAGNOSIS

CONDITION	POSSIBLE CAUSE	CORRECTION
Hard starting (Engine Cranks OK)	• Blown fuse.	Replace.
	• Faulty spark plug.	Clean and adjust plug gap or replace.
	• Loose or disconnected spark plug wires or coil wire.	Repair or replace.
	• Improper ignition timing.	Adjust.
	• Faulty ignition coil.	Replace.
	• Maladjusted signal rotor air gap.	Adjust.
	• Faulty crank angle sensor.	Replace.
	• Faulty electronic spark advance system.	Refer to ENGINE ELECTRICAL (Section 6D).
	• Cracked rotor or cap in distributor.	Replace.
	• Faulty noise suppressor.	Replace.
	• Dirty fuel filter.	Replace.
	• Dirty or clogged fuel pipe.	Clean.
	• Fuel pump will not work properly.	Replace.
	• Lack of fuel in fuel tank.	Refill.
	• Vacuum leak through inake manifold or throttle body gasket.	Replace gasket.
	• TBI	Refer to DRIVEABILITY AND EMISSIONS (Section 6E12).
	• Incorrect spark plug tightening or faulty gasket.	Tighten to specified torque or replace gasket.
	• Improper grade of engine oil or low viscosity.	Replace with proper grade oil.

CONDITION	POSSIBLE CAUSE	CORRECTION
	● Incorrect valve lash.	Adjust.
	● Compression leak from valve.	Remove cylinder head and lap valves.
	● Sticky valve stem.	Correct or replace valve and valve guide.
	● Weak or damaged valve springs.	Replace valve springs.
	● Compression leak at cylinder head gasket.	Replace gasket.
	● Sticking or damaged piston ring.	Replace piston rings.
	● Worn piston, ring, or cylinder.	Replace ring and piston. Rebore or replace cylinder.
	● Broken valve timing belt.	Replace.
	● Malfunctioning PCV.	Replace.
	● Loose or disconnected vacuum hoses.	Connect securely.
	● ECM is poorly grounded.	Ground ECM securely.
Engine has no power	● Low compression	Previously outlined.
	● Incorrect ignition timing.	Adjust.
	● Defective spark plugs.	Replace.
	● Worn distributor terminals.	Clean or replace. Also check rotor.
	● Loose or disconnected spark plug wires or coil wire.	Connect or replace as necessary.
	● Faulty electronic advance system.	Refer to ENGINE ELECTRICAL (Section 6D.)
	● Engine overheating.	Refer to "Overheating Chart" of this section.
	● Clogged fuel pipe.	Clean.
	● Dirty or clogged fuel.	Replace.

CONDITION	POSSIBLE CAUSE	CORRECTION
	• Fuel pump will not work properly.	Replace.
	• Clogged filter element.	Clean or replace.
	• Clogged air cleaner.	Clean or replace.
	• Malfunction of thermostatically controlled air cleaner.	Check and correct.
	• Loose connection or disconnection of vacuum hose.	Connect securely.
	• Air leaking from intake manifold or throttle body gasket.	Replace gasket.
	• Malfunctioning EGR valve.	Check and replace as necessary.
	• Malfunctioning high altitude switch.	Check and replace as necessary.
	• Malfunctioning throttle position switch (wide open switch).	Check and replace as necessary.
	• Dragging brakes.	Adjust or replace.
	• Slipping clutch.	Adjust or replace.
Improper engine idling or engine fails to idle	• Clogged air cleaner element.	Clean or replace.
	• Leaky manifold, throttle body, or cylinder head gaskets.	Replace.
	• Defective spark plug.	Check and replace as necessary.
	• Worn or disconnected coil wire.	Connect or replace as necessary.
	• Worn distributor terminals.	Replace.
	• Improper ignition timing.	Adjust.
	• Worn, loose connection, or disconnection of spark plug wires.	Connect or replace.

CONDITION	POSSIBLE CAUSE	CORRECTION
	● Cracked cap in distributor with leakage inside.	Replace.
	● Faulty electronic spark advance system.	Refer to ENGINE ELECTRICAL (Section 6D).
	● Loose connection or disconnect vacuum hoses.	Connect.
	● Malfunctioning PCV valve.	Check and replace as necessary.
	● Malfunctioning EGR valve.	Check and replace as necessary.
	● Low compression.	Previously outlined.
	● Loose throttle body and intake manifold bolts and nuts.	Tighten bolts and nuts.
Engine hesitates (Momentary lack of response as the accelerator is depressed. Can occur at all car speeds. Usually most severe when first trying to make the car move, as from a stop sign.)	● Improper ignition timing.	Adjust.
	● Defective spark plug or plug gap out of adjustment.	Replace or adjust gap.
	● Defective coil wire.	Replace.
	● Clogged fuel filter, hose, or pipe	Clean or replace.
	● Clogged air cleaner element.	Clean or replace.
	● Loose manifold and throttle body bolts and nuts.	Retighten.
	● Leaky manifold and throttle body/gaskets.	Replace.
	● TBI system out of order.	Refer to DRIVEABILITY AND EMISSIONS (Section 6E).
	● Malfunctioning throttle position switch (wide open switch).	Check and replace as necessary.
	● Malfunctioning high altitude switch.	Check and replace as necessary.

CONDITION	POSSIBLE CAUSE	CORRECTION
	● Malfunctioning EGR valve.	Check and replace as necessary.
	● Malfunctioning thermostatically controlled air cleaner.	Check and replace as necessary.
	● Low compression.	Previously outlined.
	● Poorly seating valve.	Repair or replace.
	● Improper valve lash.	Adjust.
Surges (Engine power variation under steady throttle or cruise. Feels like the car speeds up and down with no change in the accelerator pedal.)	● Clogged fuel filter.	Replace.
	● Kinked, leaky or damaged fuel hoses and lines.	Reroute or replace lines.
	● Malfunctioning fuel pump.	Check and replace.
	● Leaky manifold and throttle body gaskets.	Replace.
	● TBI system out of order.	Refer to DRIVEABILITY AND EMISSIONS (Section 6E12).
	● Improper ignition timing.	Adjust.
	● Incorrect ignition timing.	Check and adjust.
	● Faulty electronic spark advance system.	Refer to ENGINE ELECTRICAL (Section 6D).
	● Cracked rotor or cap in distributor.	Replace.
	● Worn or loosely connected coil wire.	Check and repair or replace.
	● Defective spark plug (excess carbon deposits, electrodes, etc.).	Check and clean, adjust or replace.
	● Malfunctioning throttle position switch (wide open switch).	Check and replace as necessary.
	● Malfunctioning high altitude switch.	Check and replace as necessary.

CONDITION	POSSIBLE CAUSE	CORRECTION
	• Malfunctioning EGR valve.	Check and replace as necessary.
	• Malfunctioning thermostatically controlled air cleaner.	Check and replace as necessary.
Excessive detonation (The engine makes sharp metallic knocks that change with throttle opening.)	• Engine over heating.	Refer to ENGINE COOLING (Section 6B).
	• Improper ignition.	Adjust.
	• Faulty spark plug.	Replace.
	• Loose connection of spark plug wire.	Connect securely.
	• Clogged fuel filter and fuel lines.	Replace or clean.
	• Malfunctioning fuel pump.	Replace.
	• Air leaking from intake manifold and throttle body gaskets.	Replace.
	• TBI system out.	Refer to DRIVEABILITY AND EMISSIONS (Section 6E12).
	• Malfunctioning EGR valve.	Replace.
	• Excessive combustion chamber deposits.	Remove carbon.
Dieseling (Engine continues to run after ignition switch is turned off it runs unevenly and may make knocking noise.)	• Improper ignition.	Check and adjust timing.
	• Malfunctioning idle circuit; idle to high.	Check and adjust.
	• Electronic fuel injection system malfunctioning.	Refer to DRIVEABILTY AND EMISSIONS (Section 6E12).
Overheating	• Insufficient coolant.	Refill.
	• Loose water pump belt.	Adjust.
	• Inoperative thermostat.	Replace.
	• Poor water pump performance.	Replace.

CONDITION	POSSIBLE CAUSE	CORRECTION
	● Improper ignition timing.	Adjust.
	● Clogged or leaky radiator.	Flush, repair or replace.
	● Leaking or not enough oil.	Refill and repair.
	● Improper engine oil grade.	Replace with proper grade oil.
	● Clogged oil filter or oil strainer.	Replace or clean (oil strainer).
	● Poor oil pump pressure.	Repair or replace.
	● Dragging brakes.	Adjust or repair.
	● Blown cylinder head gasket.	Replace.
Poor gasoline mileage	● Fuel leakage from fuel tank, lines, and throttle body.	Repair or replace.
	● Clogged air cleaner.	Clean or replace.
	● Restricted air intake system.	Repair.
	● Air leaks at throttle body or intake manifold.	Tighten bolts and nuts. Replace.
	● TBI system out of order.	Refer to DRIVEABILITY AND EMISSIONS (Section 6E12).
	● Improper ignition.	Adjust.
	● Worn or loose coil wire.	Repair or replace.
	● Defective spark plug (improper gap, heavy deposits, and burned electrodes, etc.).	Clean, adjust, or replace.
	● Faulty electronic spark advance system.	Refer to ENGINE ELECTRICAL (Section 6D).
	● Malfunctioning pulse air control valve.	Check and replace as necessary.
	● Air leaks at exhaust manifold.	Tighten manifold bolts and nuts. Replace gasket.

CONDITION	POSSIBLE CAUSE	CORRECTION
	• Oxygen sensor out of order.	Replace.
	• Water temperature switch out of order.	Replace.
	• Malfunctioning throttle position switch.	Replace.
	• Malfunctioning EGR valve.	Replace.
	• Abnormal idle-up actuator operation (Actuator operates although heater, cooling fan, rear defogger, and air conditioner are "OFF").	Check and adjust or replace.
	• Low compression.	Previously outlined.
	• Poor valve seating.	Repair or replace.
	• Improper valve lash.	Adjust.
	• Dragging brakes.	Adjust.
	• Slipping clutch.	Adjust or replace.
	• Thermostat.	Replace.
	• Improper tire pressure.	Adjust.
Excessive engine oil consumption	• Loose oil drain plug.	Tighten.
	• Loose oil pan bolts.	Tighten.
	• Deteriorated or broken oil pan seal.	Replace sealant.
	• Leaky crankshaft oil seals.	Replace.
	• Leaky cylinder head cover gasket.	Replace.
	• Improper tightening of oil filter.	Tighten.
	• Loose oil pressure switch.	Tighten.

CONDITION	POSSIBLE CAUSE	CORRECTION
	● Leaky camshaft oil seals and fuel pump gasket.	Replace.
	● Blown cylinder head gasket.	Replace.
	● Worn piston and cylinder.	Replace or rebore cylinder and replace piston.
	● Worn piston ring groove and ring.	Replace piston and ring.
	● Improper location of piston ring gap.	Reposition ring.
	● Worn or damaged valve stem seal.	Replace.
	● Worn valve stem.	Replace stem and guide.
	● Sticky piston ring.	Remove carbon and replace rings.
Low oil pressure	● Improper oil viscosity.	Use oil of proper viscosity.
	● Not enough oil.	Refill.
	● Malfunctioning oil pressure switch.	Replace.
	● Clogged oil filter.	Replace.
	● Clogged strainer.	Clean.
	● Worn oil pump relief valve.	Replace.
	● Excessive clearance various sliding parts.	Replace worn parts.
Engine noise Note: Before checking the mechanical noise, make sure that: ● Ignition timing is properly adjusted. ● Specified spark plug is used. ● Specified fuel is used.	● Faulty valve lash adjuster.	Adjust.
	● Worn valve stem and guide.	Replace.
	● Worn camshaft lobe.	Replace camshaft.
	● Worn rocker arm.	Replace.
	● Weak or broken valve spring.	Replace.

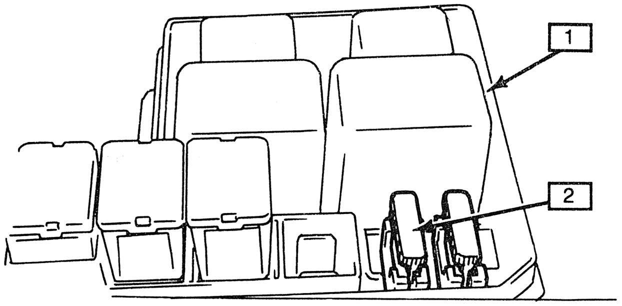
CONDITION	POSSIBLE CAUSE	CORRECTION
	● Warped or bent valve.	Replace.
	● Loose camshaft housing bolts.	Tighten to torque specification.
	● Worn piston, ring, or cylinder bore.	Rebore or replace cylinder.
	● Worn rod bearing.	Replace.
	● Worn crankpin.	Repair by grinding, or replace crankshaft.
	● Loose connecting rod nuts.	Tighten nuts to specification.
	● Low oil pressure.	Previously outlined.
	● Worn bearing.	Replace.
	● Worn crankshaft journal.	Repair by grinding, or replace crankshaft.
	● Loose bearing cap bolts.	Tighten bolts top specification.
	● Excessive crankshaft end play (thrust).	Replace thrust bearing.

COMPRESSION CHECK

Figures 4 and 5

Check the compression on all three cylinders as follows:

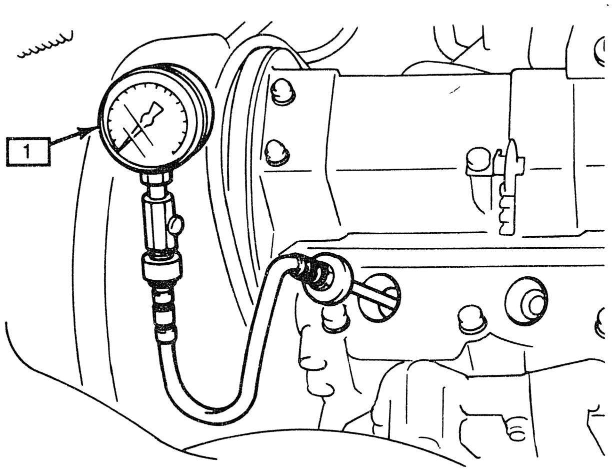
1. Warm up engine.
2. Stop engine after warming up.
3. Remove all spark plugs and disconnect distributor wire harness at connector.
4. Remove 15A fuse for main relay (Figure 4).
5. Install gage into spark plug hole.
6. Disengage the clutch (to lighten starting load on engine), and depress the accelerator pedal all the way to make the throttle full-open.
7. Crank the engine with the fully charged battery, and read the highest pressure on the compression gage.
8. *Carry out steps 5 through 7 on each cylinder to* obtain three readings.



1 MAIN FUSE BOX
2 15A FUSE FOR MAIN RELAY

KC0599-6-M-RS

Figure 4 Main Relay Fuse Location



1 COMPRESSION GAGE

	Compression Pressure
Standard	14.0 kg/cm² (199.0 psi, 1400 kPa)/400 r/min
Limit	11.0 kg/cm² (156.4 psi, 1100 kPa)/400 r/min
Max. difference between any two cylinders	1.0 kg/cm² (14.2 psi, 100 kPa)/400 r/min

LC0001-6-M-RS

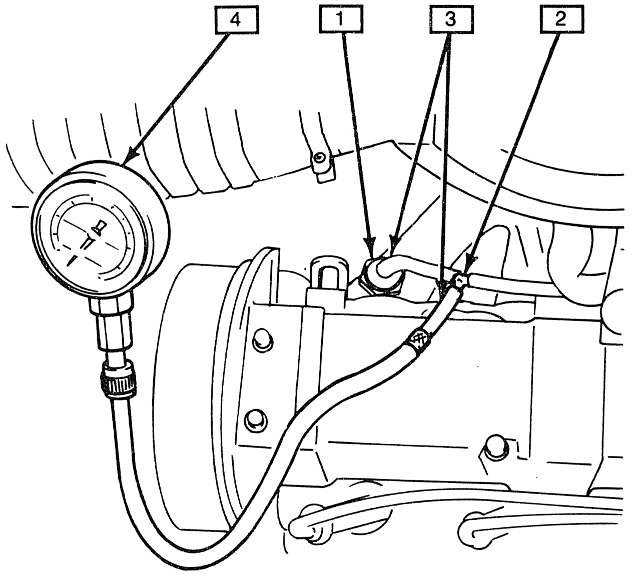
Figure 5 Compression Test

ENGINE VACUUM CHECK

Figures 6 and 7

The engine vacuum that develops in the intake line is a good indicator of the condition of the engine. The vacuum checking procedure is as follows:

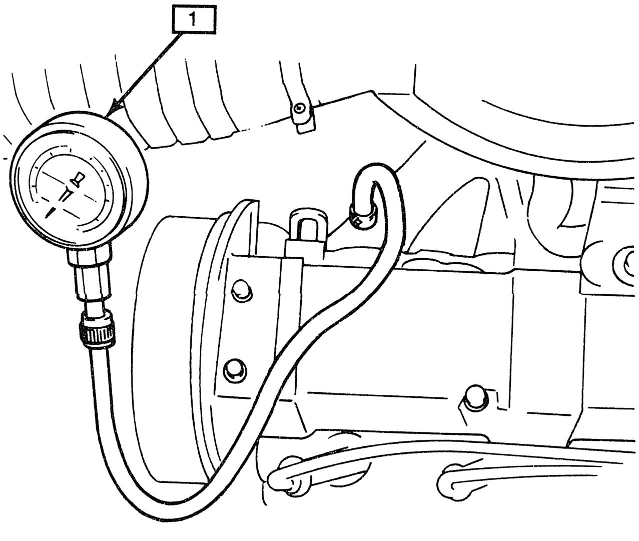
1. Warm up the engine to normal operating temperature.



1 GAS FILTER
2 VACUUM TEE
3 VACUUM HOSE
4 VACUUM GAGE

KC0601-6-M-RS

Figure 6 Installing Vacuum Gage (Metro LSI)



1 VACUUM GAGE

KC0602-6-M-RS

Figure 7 Installing Vacuum Gage (Metro)

2. With engine off, disconnect vacuum hose from gas filter. Connect three-way joint, hoses, vacuum gage, and joint between gas filter and disconnected vacuum hose (METRO) LSI. For METRO model, remove plug from intake manifold and install vacuum gage to threaded hole.
3. Run the engine at the specified idling speed (700 - 800 rpm), and read the vacuum gage. The vacuum should be within specification.
4. After checking, remove vacuum gage, joint vacuum hose. Reconnect hose to gas filter (METRO) LSI. For METRO model, remove vacuum gage, and install plug into intake manifold.

SECTION 6A1

ENGINE MECHANICAL

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GENERAL DESCRIPTION

ENGINE

The engine is a water-cooled in line 3 cylinder, 4 stoke cycle gasoline unit with a direct acting type S.O. H.C. (Single overhead camshaft) valve configuration.

The single overhead camshaft is mounted over the cylinder head; it is driven from crankshaft through timing belt, and no push rods are provided in the valve train system. The camshaft opens and closes the valves directly through the hydraulic valve lash adjusters (Figure 1).

ENGINE LUBRICATION

The oil pump is of a trochoid type, and mounted on the crankshaft at the crankshaft pully side.

Oil is drawn up through the oil pump strainer and passed the pump to the oil filter.

The filtered oil flows into two paths in cylinder block.

In one path, oil reaches the crankshaft journal bearings.

Oil from the crankshaft journal bearings is supplied to the connecting rod bearings by means of intersecting passages drilled in the crankshaft, and then injected from a small hole provided on the large end of connecting rod to lubricate piston, rings, and cylinder wall.

In another path, oil goes up the cylinder head and lubricates hydraulic valve lash adjusters, valves and camshaft, etc., after passing through the internal oilway of the rocker arm shafts.

There is a check valve in the path from the engine block to the cylinder head. It serves to keep the oil gallery and cylinder head filled with oil even when the engine is not running.

An oil relief valve is provided on the oil pump. This valve starts relieving oil pressure when the pressure comes over about 3.0 kg/cm^2 (42.7 psi, 300 kPa). Relieved oil drains back to the oil pan (Figure 2)

CYLINDER HEAD, VALVE TRAIN AND HYDRAULIC VALVE LASH ADJUSTER

The cylinder head is made of cast aluminum alloy and has three combustion chambers arranged in-line.

The single overhead camshaft is driven by the crankshaft through the timing belt. It has six cam lobes and operates the intake and exhaust valves directly through the hydraulic valve lash adjuster.

OPERATION OF HYDRAULIC VALVE LASH ADJUSTER

The hydraulic valve lash adjuster located between the camshaft and valve stem is a direct acting type.

With the engine oil delivered into it from the oil pump, the adjuster operates as follows so as to adjust the valve lash (clearance) to "O" automatically at all times.

1. When the camshaft doesn't push the valve lash adjuster, the valve lash adjuster is pushed against the cam and the body against the stem by the plunger spring force. In this state, the valve lash is kept to "O". (At "O" valve lash, the oil pressure becomes equal in the chambers "A" and "B", and the check ball closes the passage between these two chambers).
2. When the cam lobe of the camshaft starts pushing the valve lash adjuster, the valve lash adjuster and plunger are pushed downward and at the same time the body is pushed upward by the counter force from the valve stem. As a result, the chamber "B" is compressed and the pressure rises high. Then the oil in the chamber "B" leaks through the slight clearance between the body and plunger. However, as the compression time is very short, the volume hardly changes and thus the valve lash adjuster, plunger and body, as one unit, push down the valve stem to open the valve.
3. When the pushing of the camshaft against the valve lash adjuster is over, the operation as described in step 1, starts again. As the oil pressure in the chamber "B" is lower than that in "A" (for the oil in the chamber "B" under high pressure has leaked gradually in above 2.), the oil pressure in the chamber "A" pushes the check ball open to allow the oil to flow from the chamber "A" to chamber "B" till the oil pressure becomes equal between the two chambers (Figure 3).

CYLINDER BLOCK

The cylinder block is made of cast aluminum alloy and has 3 cylinders arranged "In Line". A cylindrical cast iron sleeve is installed in each cylinder.

CRANKSHAFT AND MAIN BEARINGS

A monoblock casting crankshaft is supported by 4 main bearings which are of the precision insert type. Three crank pins on the crankshaft are positioned 120° apart.

PISTONS, RINGS, PISTONS PINS AND CONNECTING RODS

The piston is cast aluminum alloy, and has two compression rings and one oil ring (Metro "Base" Model has one compression ring).

Of these compression rings (top and 2nd rings), the top ring is plated with hard chromium for improvement in abrasion resistance.

The oil ring consists of two rails and one spacer. The piston pin is offset 0.5 mm (0.02 in.) towards the major thrust pressure against the cylinder wall as the piston travels its path. Pins are chromium steel and have a floating fit in the pistons. They are retained in the connecting rods by a press fit. The connecting rods are made of forged steel, and rod bearings are of precision insert type.

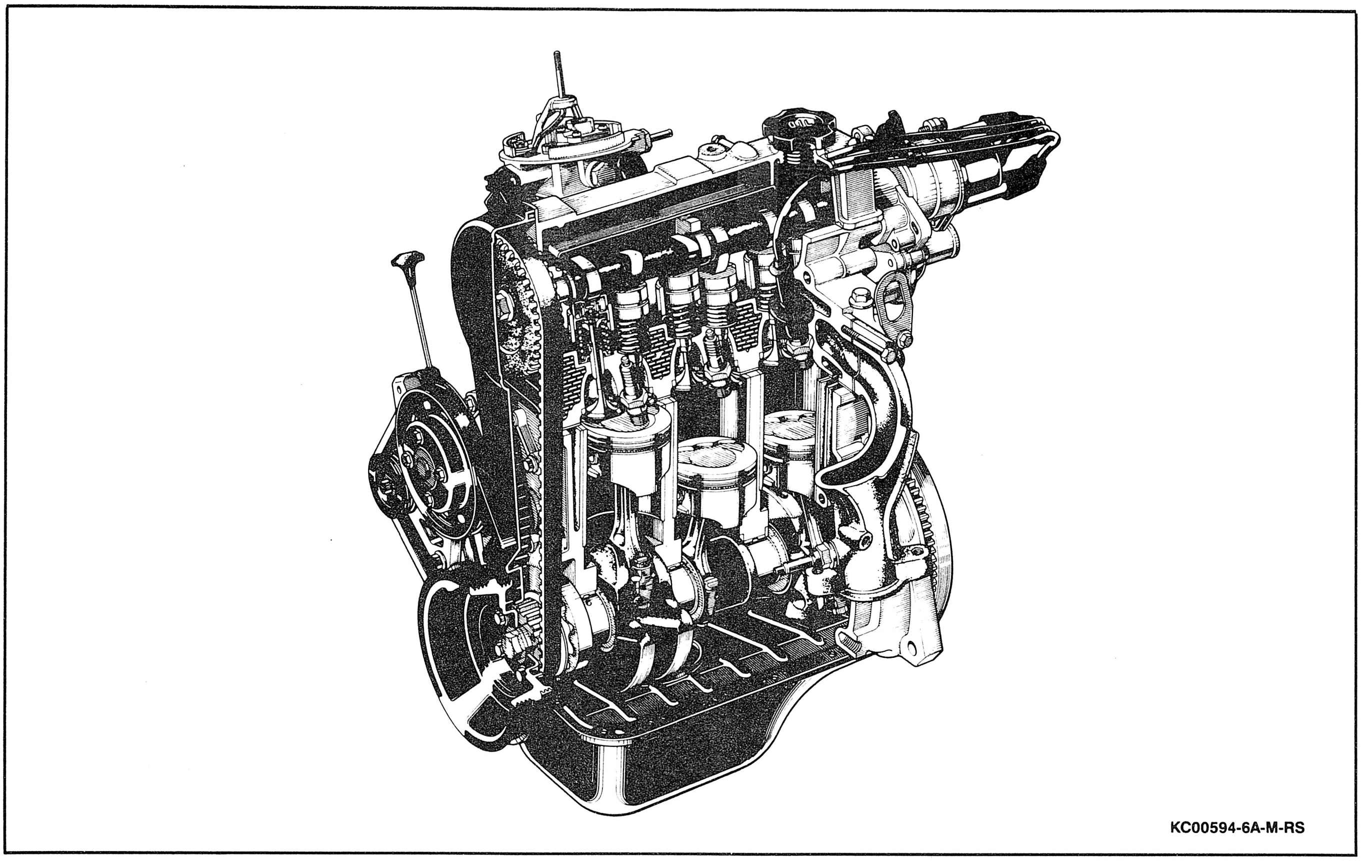
KC00594-6A-M-RS

Figure 1 Engine Construction

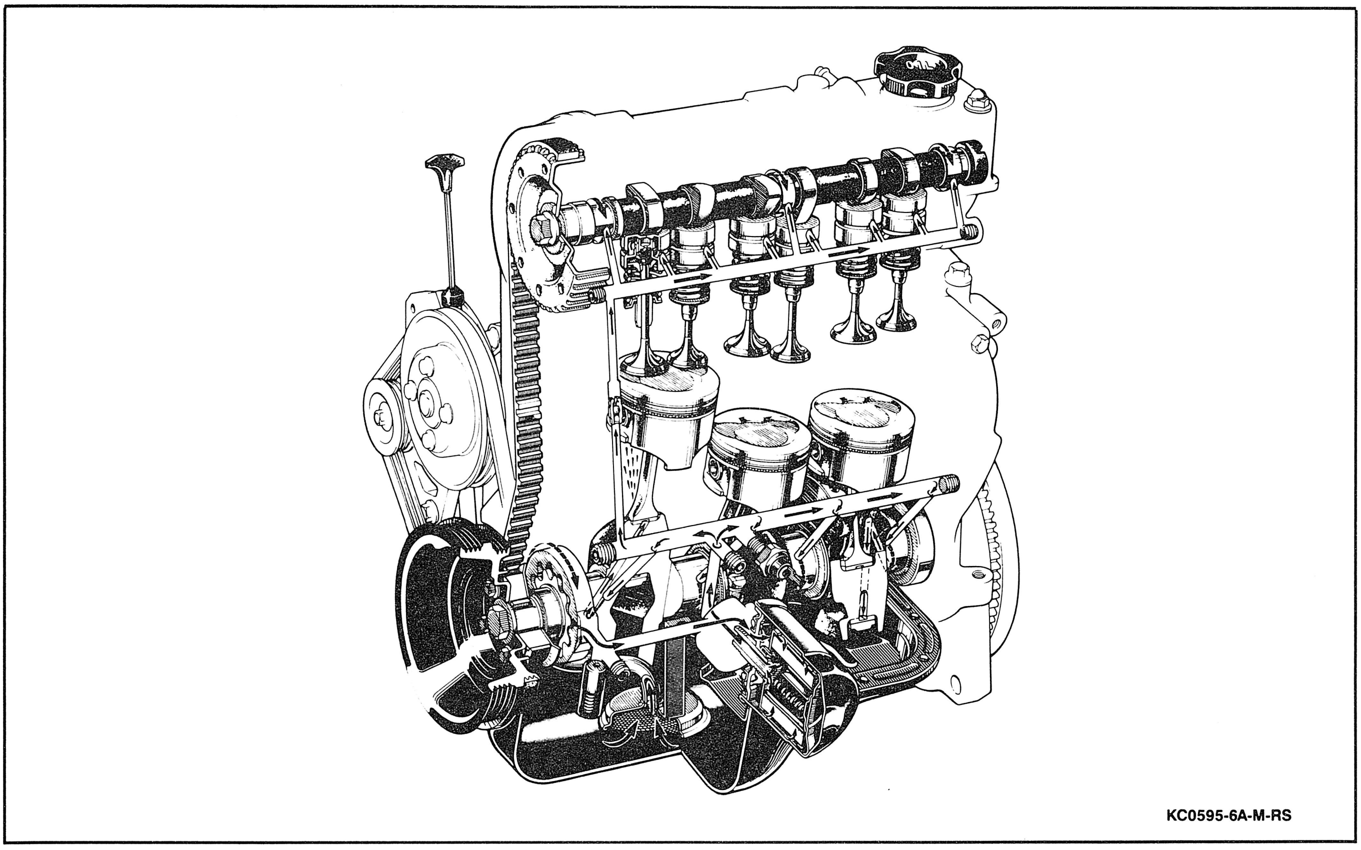
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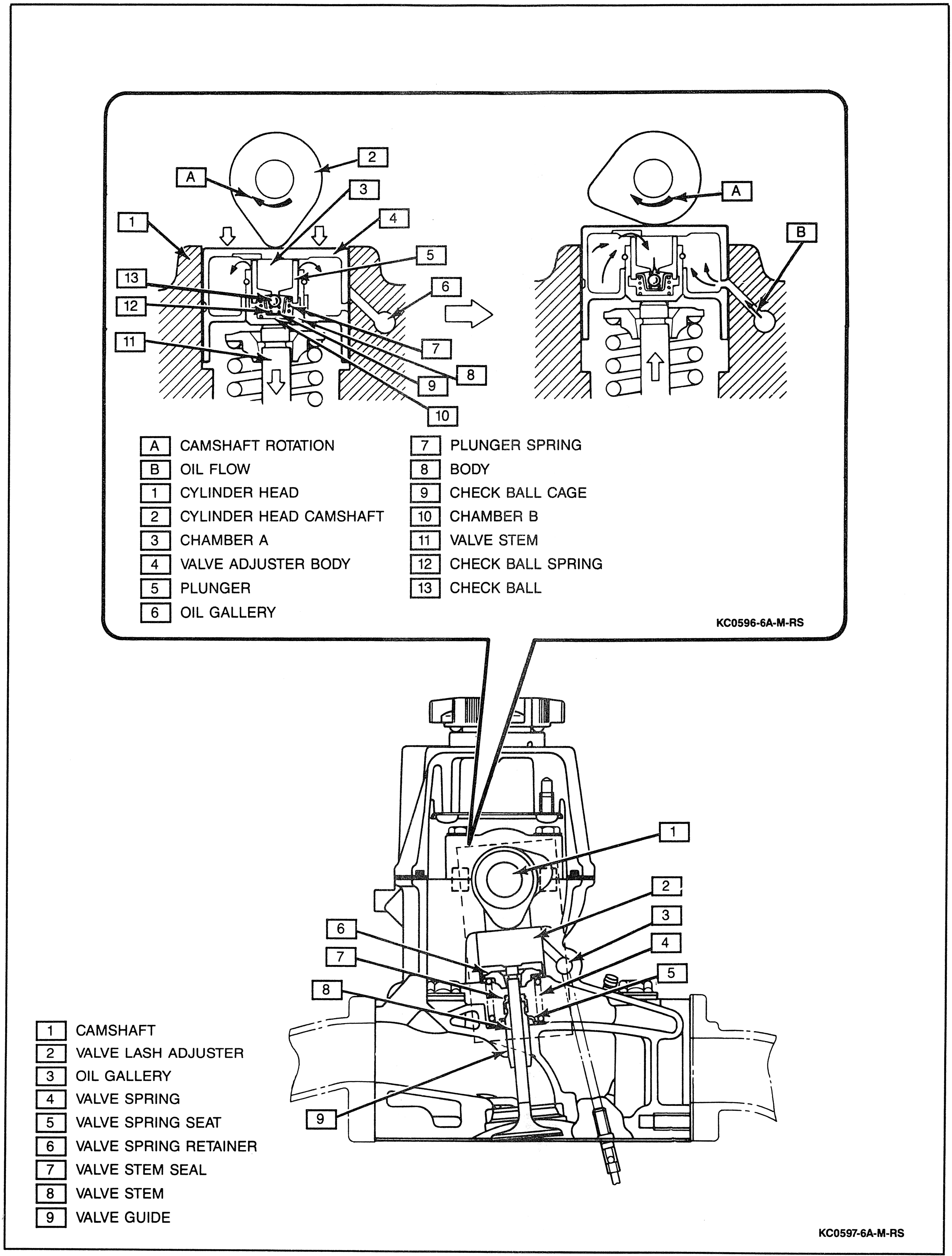
Figure 2 Engine Lubrication


A
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A
B
KC0596-6A-M-RS
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7
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8
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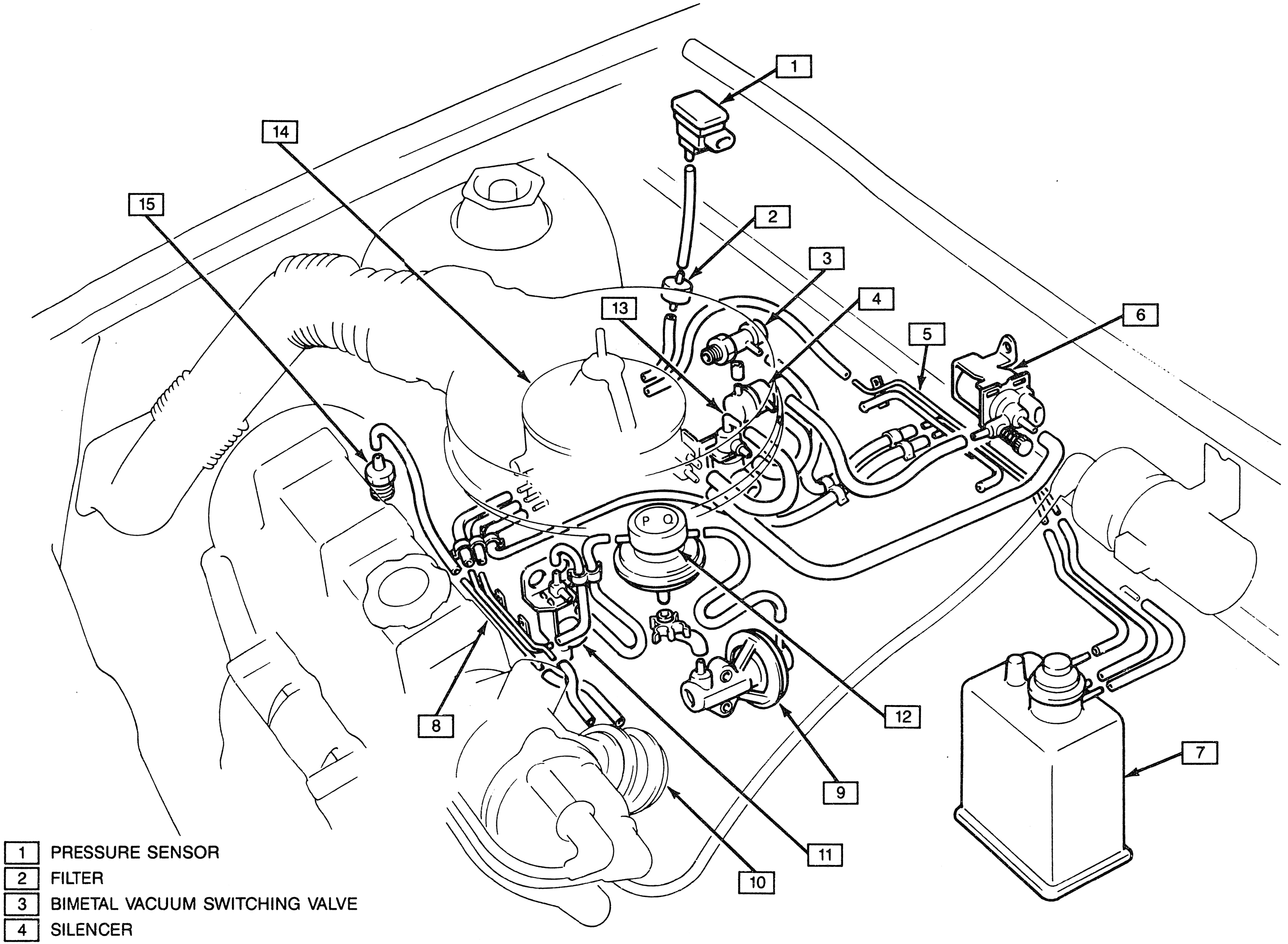
KC0597-6A-M-RS

A	CAMSHAFT ROTATION
B	OIL FLOW
1	CYLINDER HEAD
2	CYLINDER HEAD CAMSHAFT
3	CHAMBER A
4	VALVE ADJUSTER BODY
5	PLUNGER
6	OIL GALLERY
7	PLUNGER SPRING
8	BODY
9	CHECK BALL CAGE
10	CHAMBER B
11	VALVE STEM
12	CHECK BALL SPRING
13	CHECK BALL

1	CAMSHAFT
2	VALVE LASH ADJUSTER
3	OIL GALLERY
4	VALVE SPRING
5	VALVE SPRING SEAT
6	VALVE SPRING RETAINER
7	VALVE STEM SEAL
8	VALVE STEM
9	VALVE GUIDE

Figure 3 Operation of Hydraulic Valve Lash Adjuster



1	PRESSURE SENSOR
2	FILTER
3	BIMETAL VACUUM SWITCHING VALVE
4	SILENCER
5	PIPE
6	AIR-CONDITIONER VACUUM SWITCHING VALVE (FOR CAR WITH AIR-CONDITIONER ONLY)
7	CHARCOAL CANISTER
8	PIPE (CALIFORNIA SPEC. MODEL ONLY)
9	EGR VALVE (CALIFORNIA SPEC. MODEL AND METRO MODEL ONLY)
10	VACUUM ADVANCER (METRO LSI ONLY)
11	EGR VSV (CALIFORNIA SPEC. MODEL AND METRO MODEL ONLY)
12	EGR MODULATOR (CALIFORNIA SPEC. MODEL AND METRO MODEL ONLY)
13	IDLE SPEED CONTROL SOLENOID VALVE
14	THROTTLE BODY
15	GAS FILTER (METRO LSI ONLY)

LC0001-6A-M-RS

Figure 4 Vacuum Hose Connections and Routing

ON-VEHICLE SERVICE

ENGINE MOUNT (FRONT)

Remove or Disconnect

1. Negative battery cable.
2. Motor mount nut.
3. Raise vehicle.
4. Support engine.
5. Mount and frame bracket.
6. Mount from bracket.

Install or Connect

1. New mount to frame bracket.
2. Mount and frame bracket.
3. Remove support.
4. Lower vehicle.
5. Motor mount nut.
6. Negative battery cable.

ENGINE MOUNT (REAR)

Remove or Disconnect

1. Battery negative cable.
2. Mount nut.
3. Raise vehicle.
4. Mount to body bracket retaining nut.
5. Support engine.
6. Frame bracket.
7. Mount.

Install or Connect

1. Mount.
2. Frame bracket.
3. Remove support.
4. Mount to body bracket retaining nut.
5. Lower vehicle.
6. Mount nut.
7. Negative battery cable.

AIR CLEANER ELEMENT

This air cleaner element is of dry type. Remember that it needs cleaning according to following procedure.

Remove or Disconnect

1. Air cleaner upper case after removing case nut and four clamps.
2. Air cleaner element.

Inspect

- Check air cleaner element for dirt.

Clean

- Blow out dust with compressed air from inside of element.

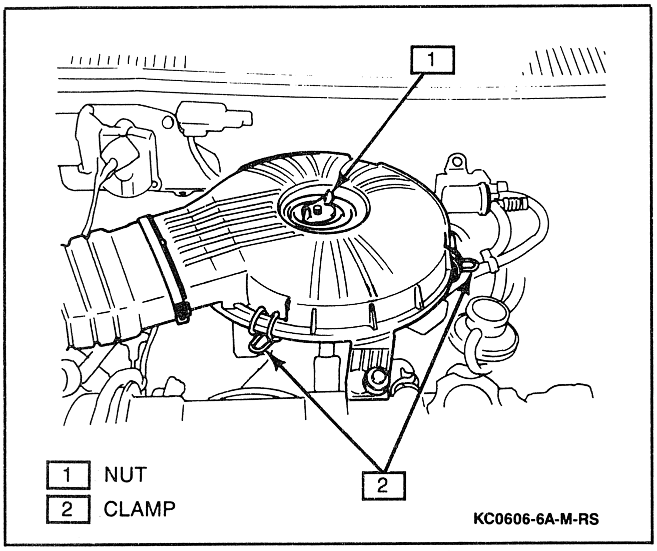


Figure 5 Removing Upper Case

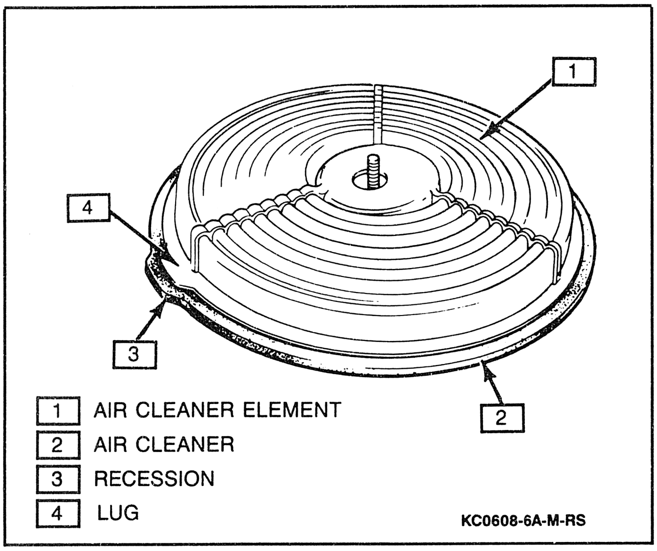


Figure 6 Installing Air Cleaner Element

Install or Connect

1. Air cleaner element to its lower case. Fit lug of element to the recession of lower case (Figure 6).
2. Air cleaner upper case. Tighten case nut and clamps securely.

AIR CLEANER ASSEMBLY

Remove or Disconnect

1. Negative battery cable.
2. Coupler from Air Temperature Sensor.
3. Idle speed control solenoid valve hose from air cleaner lower case.
4. PCV valve hose from air cleaner lower case.
5. Air cleaner assembly with air cleaner hose from throttle body. Remove air cleaner case nut and bolt, and disconnect air cleaner hose from its pipe.

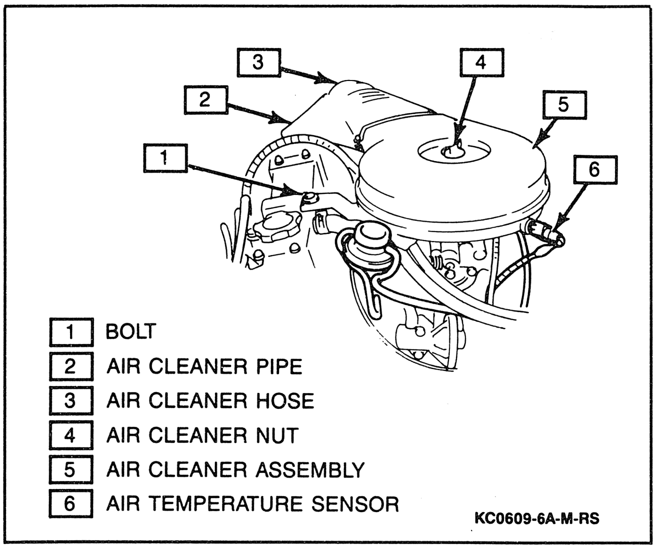


Figure 7 Removing Air Cleaner Assembly

Install or Connect

NOTICE: Before installing, make sure that air cleaner case seal is installed to air cleaner case securely.

1. Insert air cleaner hose to its pipe and clamp it securely.

THROTTLE BODY AND INTAKE MANIFOLD

Remove or Disconnect

1. Relieve fuel pressure. Refer to ENGINE FUEL (Section 6C).
2. Negative battery cable.
3. Drain engine coolant.

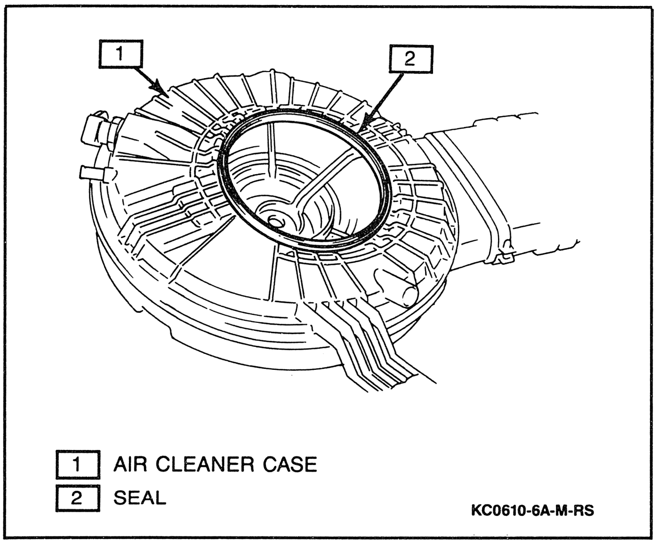


Figure 8 Air Cleaner Case Seal

CAUTION: To avoid danger of being burned, do not remove drain plug and radiator cap while engine and radiator are still hot. Scalding fluid and steam can be blown out under pressure if plug and cap are taken off too soon.

4. Air cleaner assembly as previously outlined.
5. Following electric wires:
   - Vacuum switching valve for EGR valve.
   - Water temperature sensor.
   - Idle speed control solenoid valve.
   - Ground wires from intake manifold.
   - Fuel injector.
   - Throttle switch or throttle position sensor.
   - Water temperature gage.
6. Fuel return and feed hoses from throttle body.
7. Water hoses from throttle body and intake manifold.
8. Following vacuum hoses:
   - Canister purge hose from intake manifold.
   - Canister hose from its pipe.
   - Pressure sensor hose from intake manifold.
   - Brake booster hose from intake manifold.
9. PCV hose from cylinder head cover.
10. Accelerator cable from throttle body.
11. Other lines and cables, as necessary.
12. Intake manifold with throttle body from cylinder head.

Install or Connect

1. Intake manifold gasket to cylinder head. Use a new gasket.
2. Intake manifold with throttle body to cylinder head.
   - Install clamps (Figure 12).

   Tighten

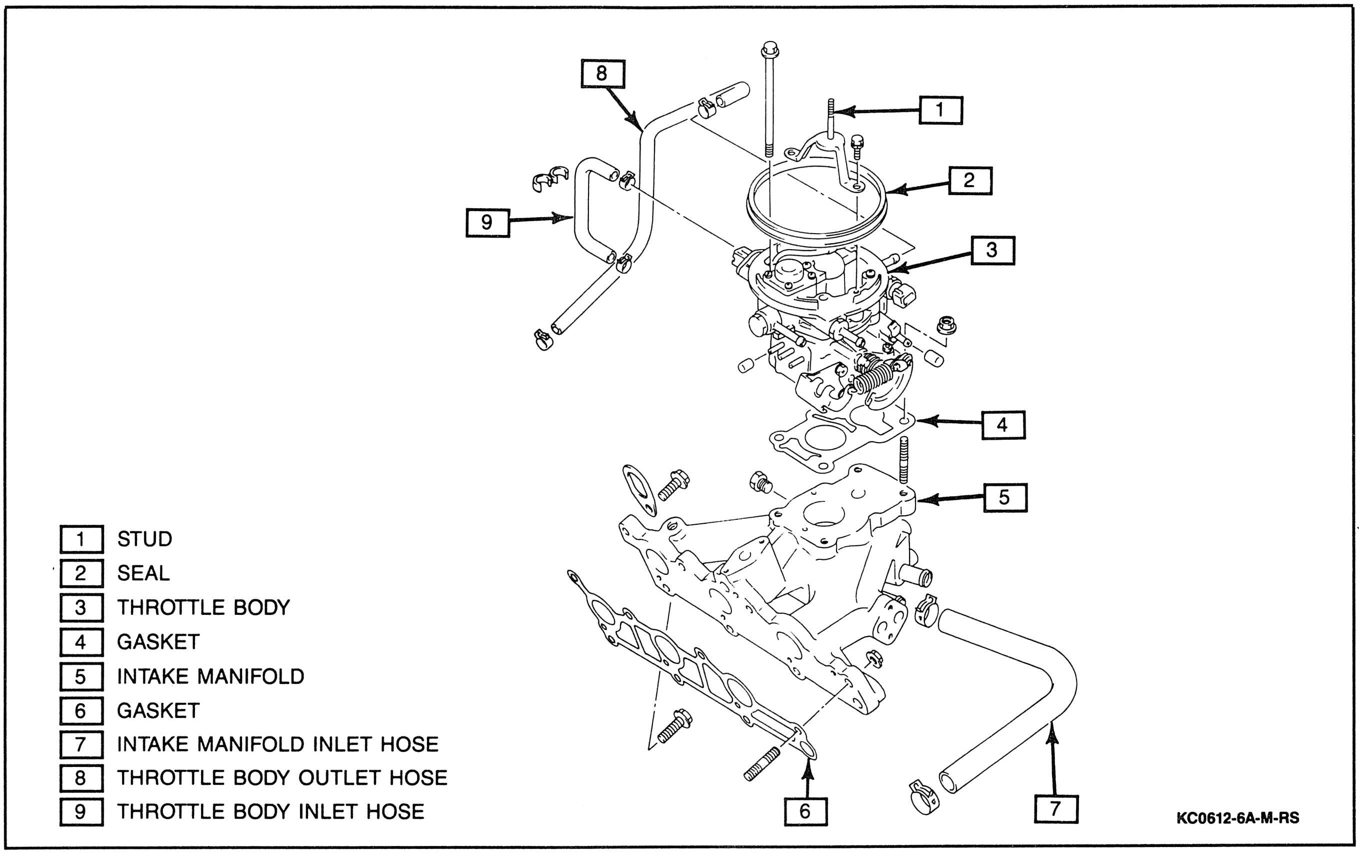
   - Bolts to 23 N·m (17 lb.ft.).
3. PCV hose to cylinder head cover.
4. Vacuum hoses (Figure 4).
5. Water hoses (Figure 11).
6. Fuel return and feed hoses to throttle body (Figure 13).
7. Electrical lead wires.
8. Accelerator cable to throttle body.

   Adjust

   - Accelerator cable play to specification. Refer to DRIVEABILITY AND EMISSIONS (Section 6E).
9. Air cleaner assembly to throttle body as previously outlined.
10. Check to ensure that all removed parts are back in place. Reinstall any necessary parts which have not been reinstalled.
11. Refill cooling system.
12. Negative battery cable.
13. Upon completion of installation, start engine and check for fuel leaks and engine cooling water leaks.

EXHAUST MANIFOLD

CAUTION: To avoid danger of being burned, do not service exhaust system while it is still hot. Service should be performed after system cools down.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4
5
1 STUD
2 SEAL
3 THROTTLE BODY
4 GASKET
5 INTAKE MANIFOLD
6 GASKET
7 INTAKE MANIFOLD INLET HOSE
8 THROTTLE BODY OUTLET HOSE
9 THROTTLE BODY INLET HOSE
6
7
KC0612-6A-M-RS

Figure 9 Throttle Body and Intake Manifold

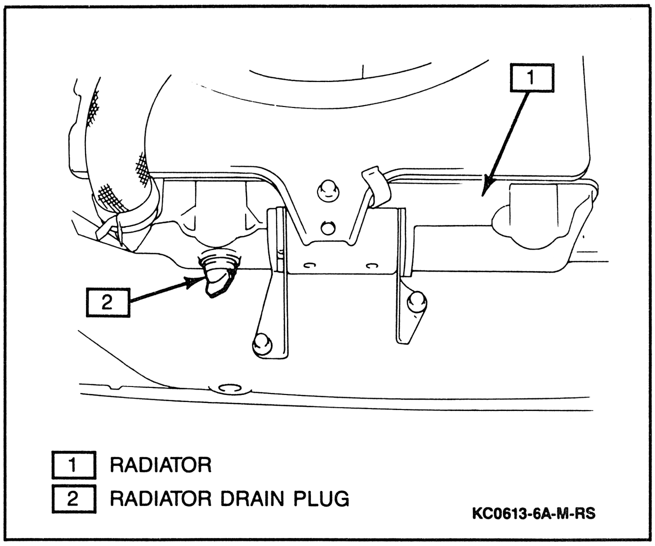

1
2
1 RADIATOR
2 RADIATOR DRAIN PLUG
KC0613-6A-M-RS

Figure 10 Radiator Drain Plug

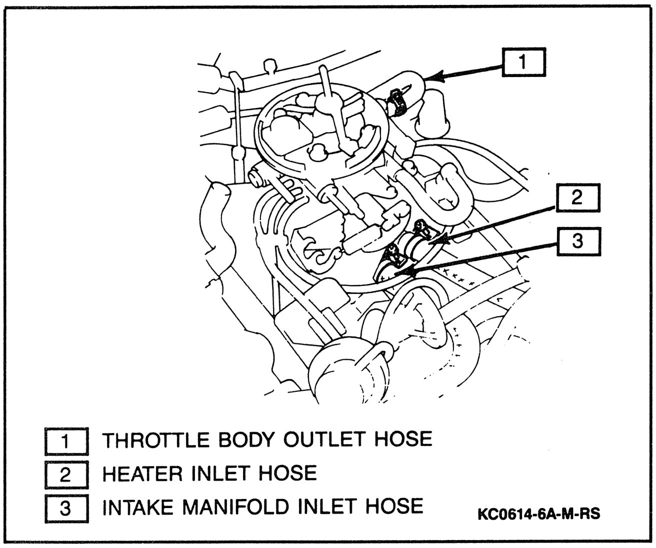

1
2
3
1 THROTTLE BODY OUTLET HOSE
2 HEATER INLET HOSE
3 INTAKE MANIFOLD INLET HOSE
KC0614-6A-M-RS

Figure 11 Water Hoses

Remove or Disconnect

1. Negative battery cable.
2. Oxygen sensor coupler. Release its wire from clamps (Figure 15).
3. Exhaust No. 1 pipe from exhaust manifold (Figure 16).
4. Exhaust manifold and its gasket from cylinder head.

Install or Connect

1. Manifold gasket to cylinder head.

NOTICE: Before installing gasket, check it for deterioration or damage, and replace as necessary.

2. Exhaust manifold.

Tighten

- Manifold bolts and nuts to 23 N·m (17 lb.ft.).

3. Pipe seal and exhaust No. 1 pipe.

NOTICE: Before installing pipe seal, check for deterioration or damage, and replace as necessary.

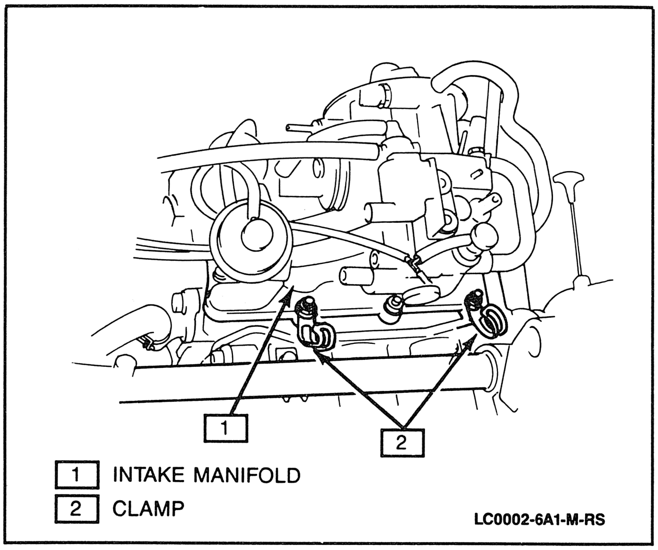

1
2
1 INTAKE MANIFOLD
2 CLAMP
LC0002-6A1-M-RS

Figure 12 Clamps

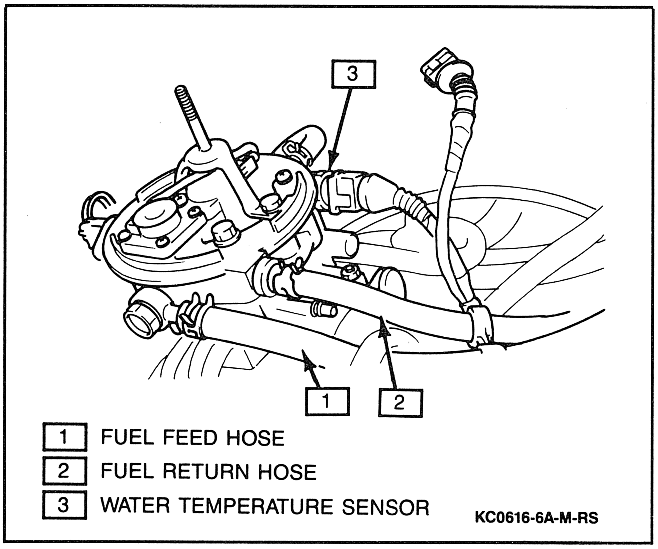

3
1
2
1 FUEL FEED HOSE
2 FUEL RETURN HOSE
3 WATER TEMPERATURE SENSOR
KC0616-6A-M-RS

Figure 13 Connecting Hoses and Connector

Tighten

- Pipe bolts to 50 N·m (37 lb.ft.).

4. Oxygen sensor coupler. Clamp its wire securely.
5. Negative battery cable.
6. Check exhaust system for exhaust gas leakage.

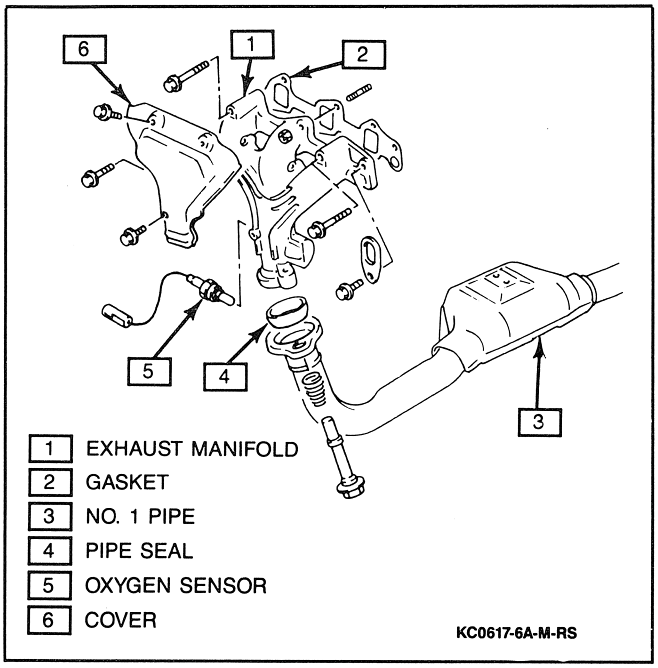
CYLINDER HEAD COVER

Remove or Disconnect

1. Negative battery cable.
2. Air cleaner assembly as previously outlined.
3. Spark plug wire clamps from cylinder head cover.
4. Cylinder head cover nuts and then seal washers (Figure 17).
5. Cylinder head cover from cylinder head.

Install or Connect

1. Cylinder head cover gasket to head cover.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5
4
3
1 EXHAUST MANIFOLD
2 GASKET
3 NO. 1 PIPE
4 PIPE SEAL
5 OXYGEN SENSOR
6 COVER
KC0617-6A-M-RS

Figure 14 Exhaust Manifold, No. 1 Pipe

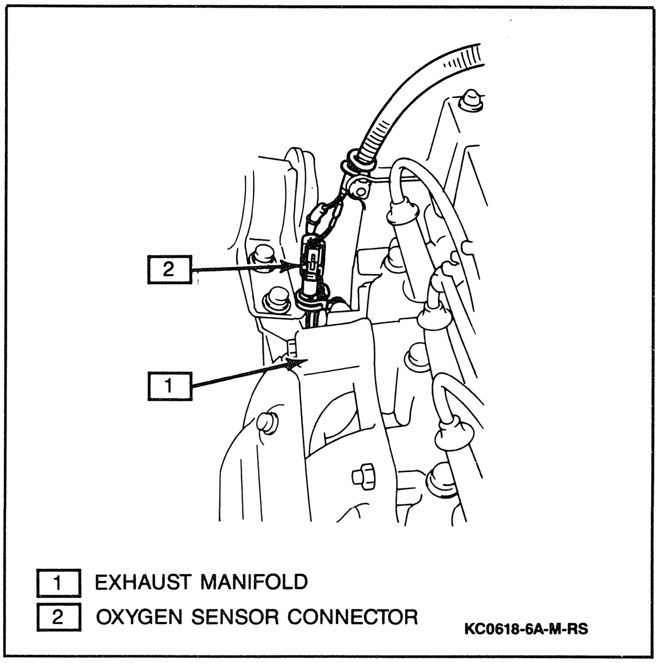

2
1
1 EXHAUST MANIFOLD
2 OXYGEN SENSOR CONNECTOR
KC0618-6A-M-RS

Figure 15 Oxygen Sensor Coupler

NOTICE: Before installing gasket, check it for deterioration or damage, and replace as necessary.

2. Cylinder head cover seal washer.

NOTICE: Before installing seal washers, check each one for deterioration or damage, and replace as necessary.

Tighten

- Cover nuts to 5 N·m (4 lb.ft.).

3. Spark plug wire clamps to cylinder head cover.

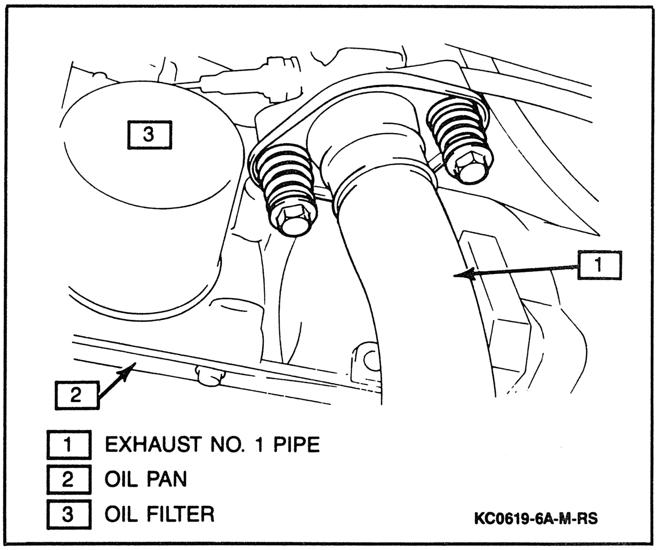


Figure 16 Exhaust No. 1 Pipe

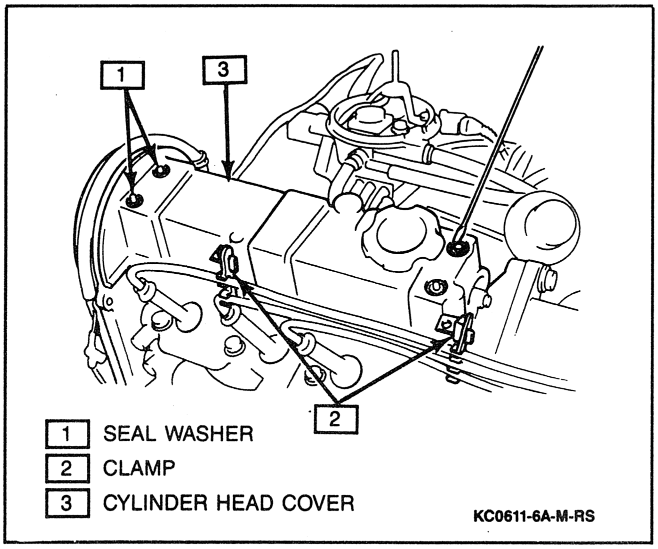


Figure 17 Removing Seal Washers

4. Air cleaner assembly as previously outlined.
5. Negative battery cable.

TIMING BELT AND BELT TENSIONER

Figures 18 through 31

Remove or Disconnect

1. Negative battery cable.
2. Hoist vehicle.
3. Fender apron extension on right side. Remove clip after pushing center pin (Figure 19).
4. Water pump belt and its pulley. Loosen generator pivot bolts and its adjusting bolt and remove water pump belt.
5. Crankshaft pulley by removing four pulley bolts.

NOTICE: It is not necessary to loosen crankshaft timing belt pulley bolt at the center.

6. Timing belt outside cover.
7. Before removal of timing belt, align four timing marks by turning crankshaft (Figure 21).
8. Timing belt tensioner, tensioner plate, tensioner spring, spring damper and timing belt.

Important

- After timing belt is removed, never turn camshaft and crankshaft independently more than such an extent (Figure 23). If turned, interference may occur among pistons and valves, and parts related to pistons and valves may be damaged.

Inspect

- Timing belt for wear or crack. Replace it as necessary.
- Tensioner for smooth rotation.

Install or Connect

1. Tensioner plate to tensioner. Insert lug of tensioner plate into hole of tensioner.
2. Tensioner and tensioner plate: Do not tighten tensioner bolt with wrench yet. Hand tighten only at this time. Check to ensure that plate movement in arrow direction (Figure 25) causes tensioner to move in the same direction. If no associated movement between plate and tensioner occurs, remove tensioner and plate again and reinsert plate lug into tensioner hole.
3. Check that timing mark on camshaft timing belt pulley is aligned with "V" mark on cylinder head cover. If not, align two marks by turning camshaft but be careful not to turn it more than its allowable turning range (Figure 23).
4. Check that punch mark on crankshaft timing belt pulley is aligned with arrow mark on oil pump case. If not, align two marks by turning crankshaft but be careful not to turn it more than its allowable turning range.
5. Timing belt, tensioner spring and damper. With two sets of marks aligned and tensioner plate pushed up, install timing belt on two pulleys such a way that drive side of belt is free from any slack. Then install tensioner spring and spring damper (Figure 28), hand tighten tensioner stud.

Important

- When installing timing belt, match arrow mark on timing belt with rotating direction of crankshaft.
- In this state, No. 1 piston is at top dead center of compression stroke.

6. To take up slack of timing belt, turn crankshaft two rotations clockwise after installing it. After making sure that belt is free from slack, tighten tensioner stud first to 11 N·m (8 lb.ft.), tensioner bolt to 27 N·m (20 lb.ft.). Then confirm again that two sets of marks are aligned respectively.
7. Timing belt outside cover.

NOTICE: Before installing, make sure that seal is between water pump and oil pump case.

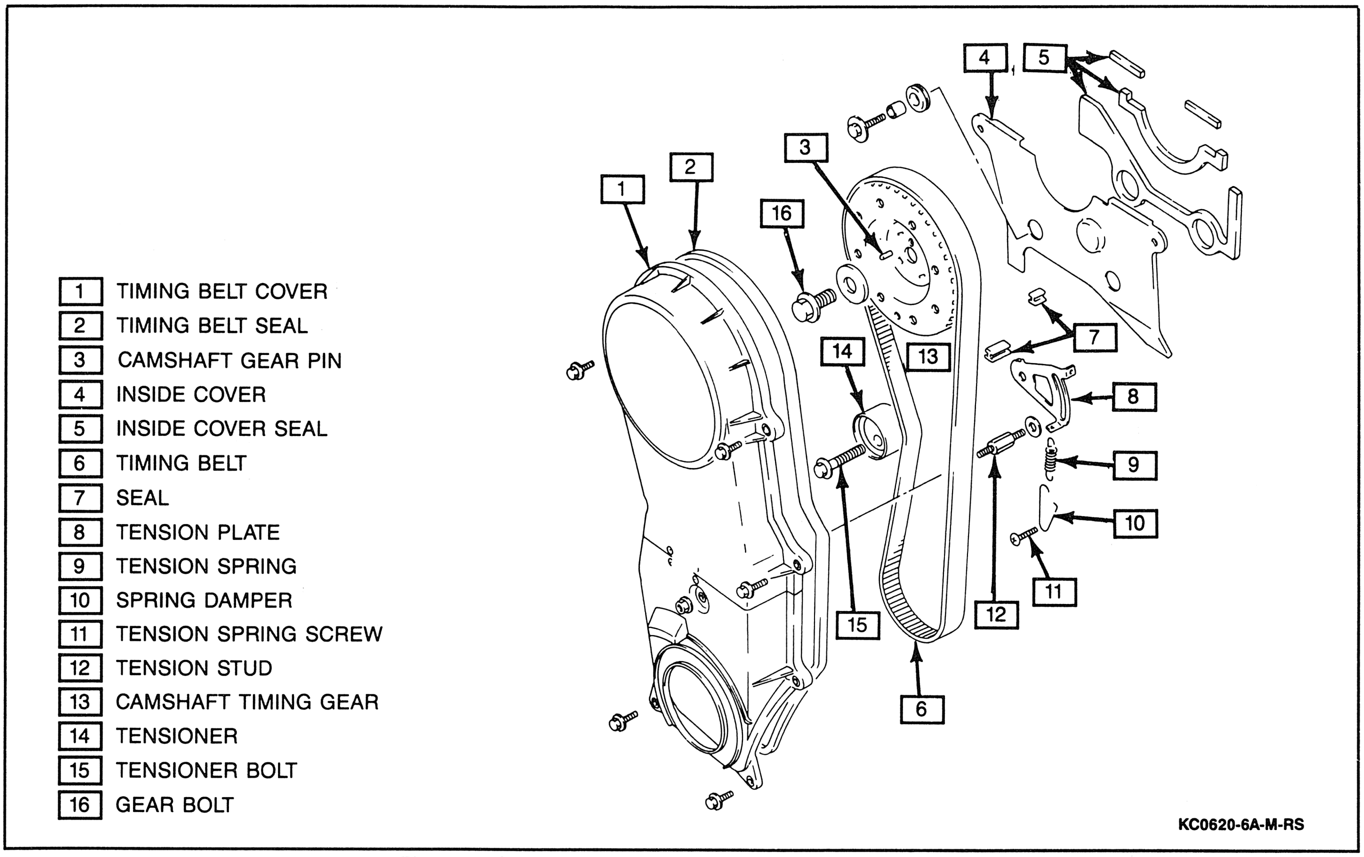

1 TIMING BELT COVER
2 TIMING BELT SEAL
3 CAMSHAFT GEAR PIN
4 INSIDE COVER
5 INSIDE COVER SEAL
6 TIMING BELT
7 SEAL
8 TENSION PLATE
9 TENSION SPRING
10 SPRING DAMPER
11 TENSION SPRING SCREW
12 TENSION STUD
13 CAMSHAFT TIMING GEAR
14 TENSIONER
15 TENSIONER BOLT
16 GEAR BOLT
KC0620-6A-M-RS

Figure 18 Timing Belt, Tensioner and Camshaft

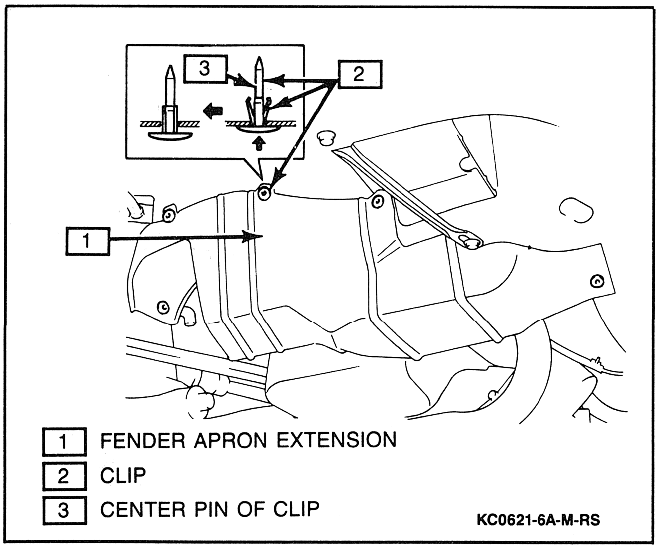

1 FENDER APRON EXTENSION
2 CLIP
3 CENTER PIN OF CLIP
KC0621-6A-M-RS

Figure 19 Removing Fender Apron Extension

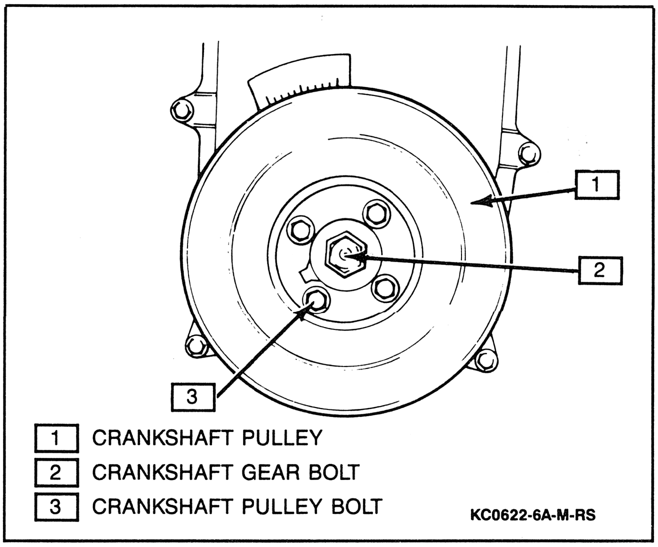

1 CRANKSHAFT PULLEY
2 CRANKSHAFT GEAR BOLT
3 CRANKSHAFT PULLEY BOLT
KC0622-6A-M-RS

Figure 20 Crankshaft Pulley and Pulley Bolts

Tighten

- Timing belt cover nut and bolts to 11 N·m (8 lb.ft.).

8. Crankshaft pulley. Fit keyway on pulley to the key on crankshaft timing belt pulley.

Tighten

- Crankshaft pulley bolts (4) to 11 N·m (8 lb.ft.).

9. Water pump pulley and water pump belt.

Adjust

- Belt tension to specification. Refer to ENGINE COOLING (Section 6B).

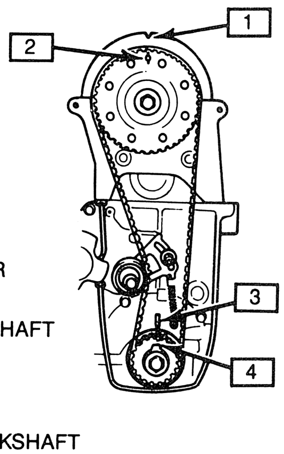
10. Fender apron extension of right side.
11. Lower vehicle.
12. Negative battery cable.

OIL PAN AND OIL PUMP STRAINER

Figures 32 through 35

Remove or Disconnect

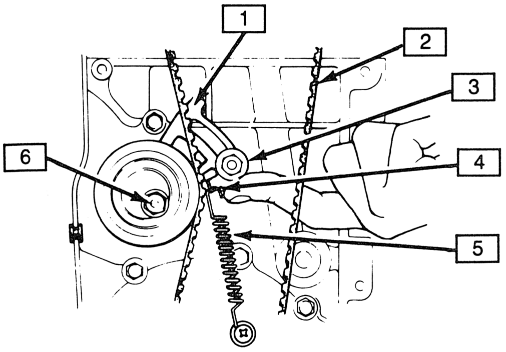
1. Negative battery cable.



1 "V" MARK ON CYLINDER HEAD COVER
2 TIMING MARK ON CAMSHAFT TIMING BELT GEAR
3 ARROW MARK ON OIL PUMP CASE
4 PUNCH MARK ON CRANKSHAFT TIMING BELT GEAR

KC0623-6A-M-RS

Figure 21 Aligning Timing Marks



1 TENSIONER PLATE
2 TIMING BELT
3 TENSIONER STUD
4 SPRING DAMPER
5 SPRING
6 TENSIONER BOLT

LC0003-6A1-M-RS

Figure 22 Timing Belt Tensioner and Belt

2. Raise vehicle.
3. Drain oil.
4. Flywheel inspection cover.
5. Exhaust pipe at manifold.
6. Oil pan bolts.
7. Oil pan.
8. Oil pump strainer.

Clean

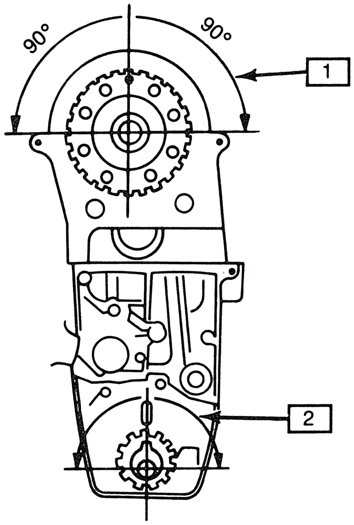
- Inside of oil pan and oil strainer screen.

Install or Connect

1. Oil pump strainer and seal (Figure 33).

Tighten

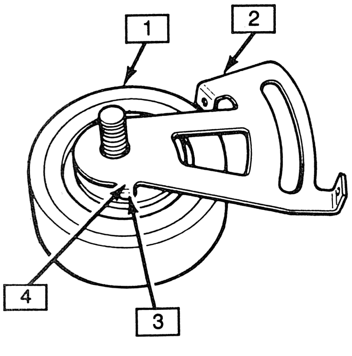
- Strainer bolt first and then the bracket bolt to 11 N·m (8 lb.ft.).



1 CAMSHAFT ALLOWABLE TURNING RANGE . . . BY TIMING MARK, WITHIN 90° FROM "V" MARK ON HEAD COVER ON BOTH RIGHT AND LEFT.
2 CRANKSHAFT ALLOWABLE TURN RANGE . . . BY PUNCH MARK, WITHIN 90° FROM ARROW MARK ON OIL PUMP CASE ON BOTH RIGHT AND LEFT.

KC0625-6A-M-RS

Figure 23 Allowable Turning Range



1 TENSIONER
2 TENSIONER PLATE
3 HOLE
4 LUG

LC0004-6A1-M-RS

Figure 24 Lug and Hole

Clean

- Mating surfaces of oil pan and cylinder block. After cleaning, apply a continuous bead of GM sealer #1052751 to oil pan mating surface.

2. Oil pan to cylinder block.

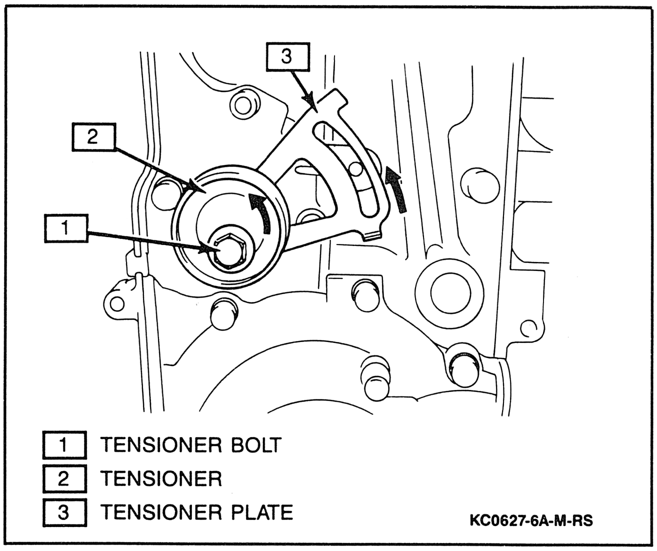

1 TENSIONER BOLT
2 TENSIONER
3 TENSIONER PLATE
KC0627-6A-M-RS

Figure 25 Tensioner Installation

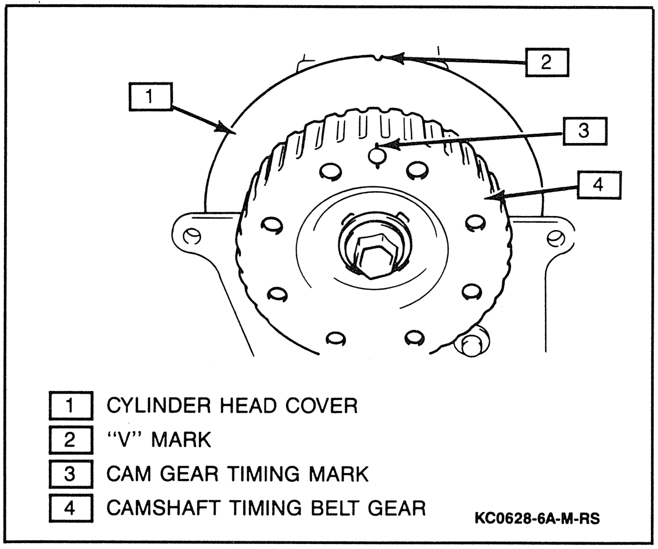

1 CYLINDER HEAD COVER
2 "V" MARK
3 CAM GEAR TIMING MARK
4 CAMSHAFT TIMING BELT GEAR
KC0628-6A-M-RS

Figure 26 Timing Marks

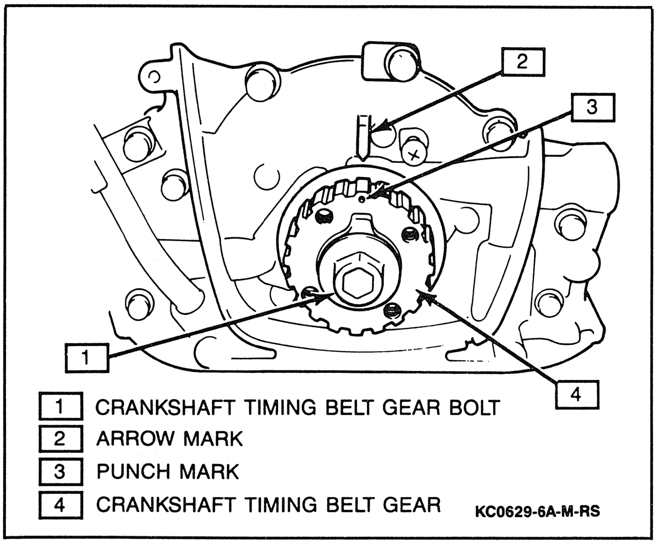

1 CRANKSHAFT TIMING BELT GEAR BOLT
2 ARROW MARK
3 PUNCH MARK
4 CRANKSHAFT TIMING BELT GEAR
KC0629-6A-M-RS

Figure 27 Timing Marks

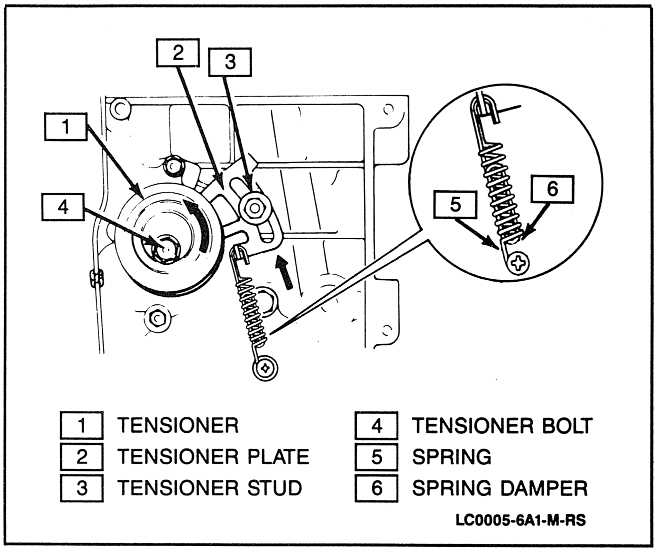

1 TENSIONER
2 TENSIONER PLATE
3 TENSIONER STUD
4 TENSIONER BOLT
5 SPRING
6 SPRING DAMPER
LC0005-6A1-M-RS

Figure 28 Tensioner Installation

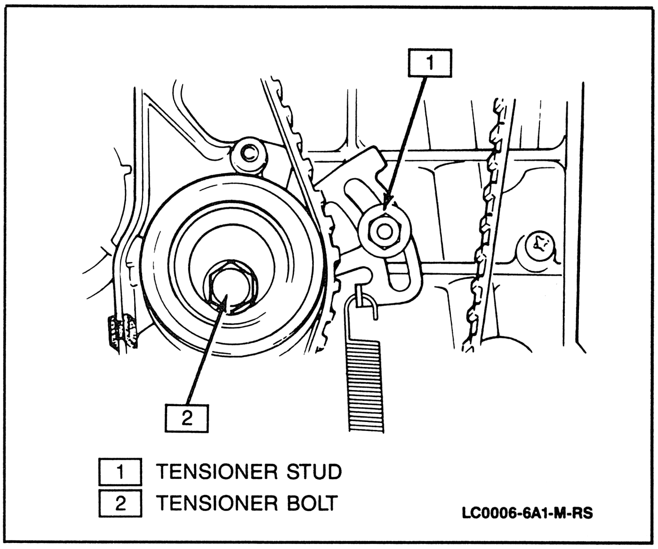

1 TENSIONER STUD
2 TENSIONER BOLT
LC0006-6A1-M-RS

Figure 29 Tensioner Bolt and Stud

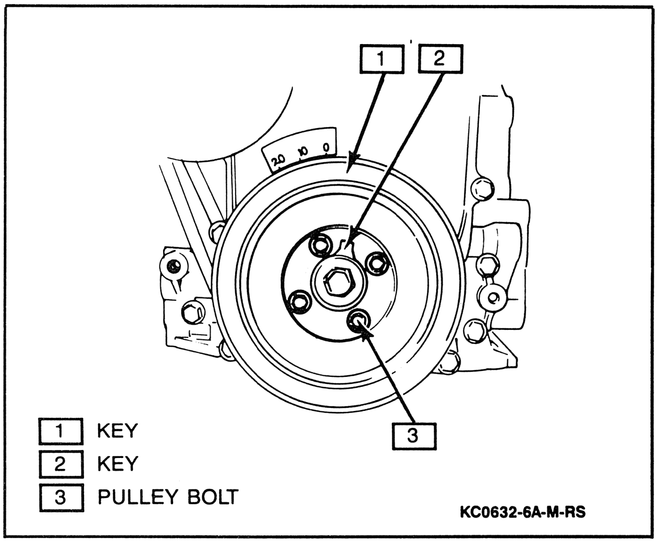

20
10
0
1 KEY
2 KEY
3 PULLEY BOLT
KC0632-6A-M-RS

Figure 30 Installing Crankshaft Pulley

NOTICE: After fitting the oil pan to the block, attach bolts and start tightening at the center outward.

Tighten

- Bolts to 11 N·m (8 lb.ft.).

3. Gasket and drain plug to oil pan.

Tighten

- Drain plug to 35 N·m (26 lb.ft.).

4. Exhaust pipe at manifold.
5. Flywheel inspection cover.
6. Lower vehicle.
7. Refill oil.
8. Negative battery cable.

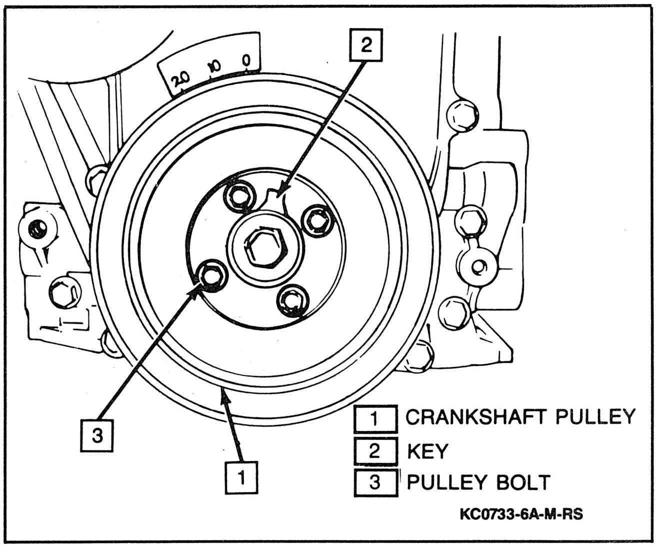

20
10
0
2
3
1
1 CRANKSHAFT PULLEY
2 KEY
3 PULLEY BOLT
KC0733-6A-M-RS

Figure 31 Installing Crankshaft Pulley

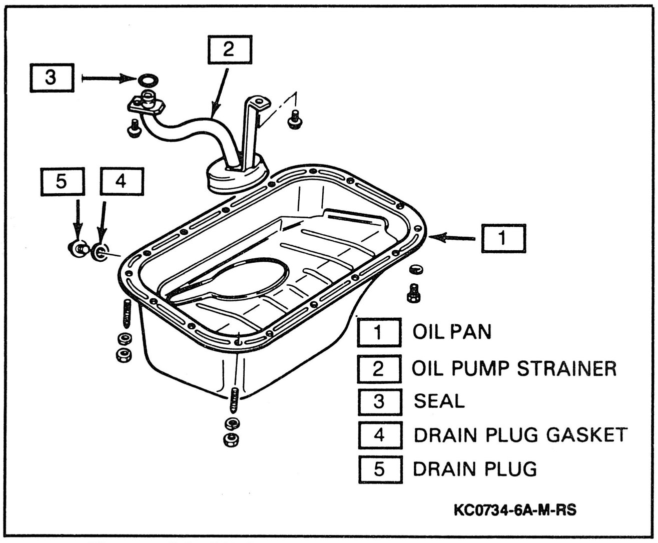

2
3
5
4
1
1 OIL PAN
2 OIL PUMP STRAINER
3 SEAL
4 DRAIN PLUG GASKET
5 DRAIN PLUG
KC0734-6A-M-RS

Figure 32 Oil Pan and Oil Pump Strainer

OIL PUMP

Remove or Disconnect

1. Negative battery cable.

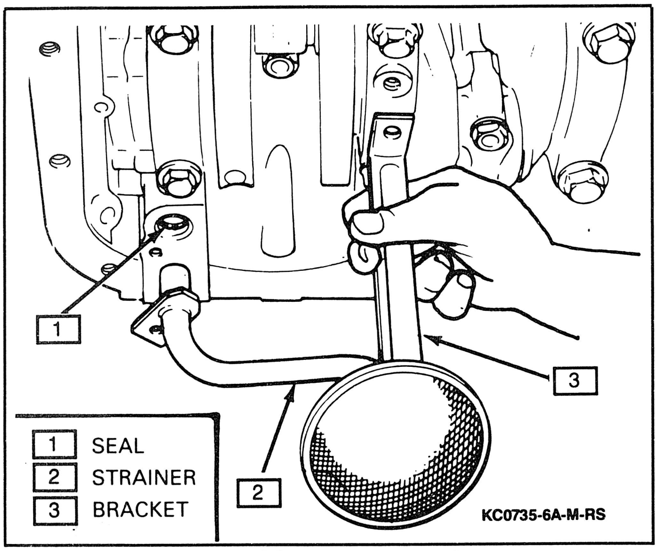

1
3
2
1 SEAL
2 STRAINER
3 BRACKET
KC0735-6A-M-RS

Figure 33 Installing Seal

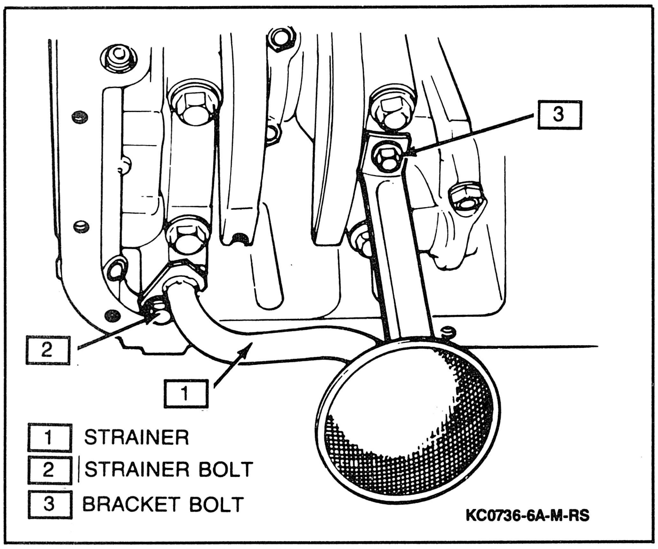

3
2
1
1 STRAINER
2 STRAINER BOLT
3 BRACKET BOLT
KC0736-6A-M-RS

Figure 34 Installing Oil Pump Strainer

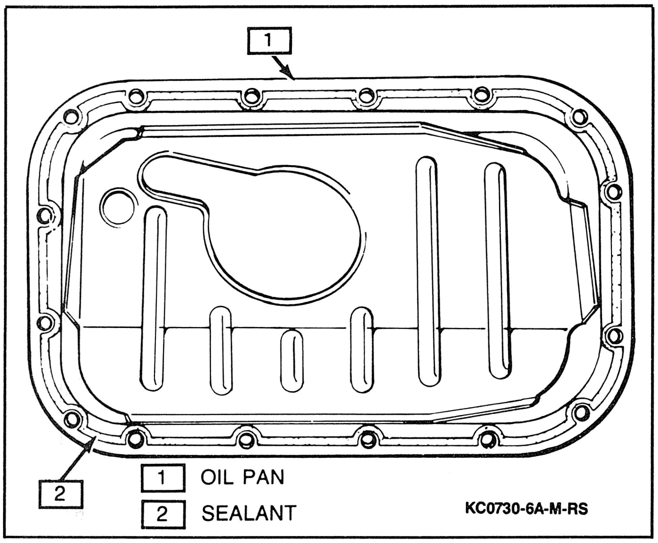

1
2
1 OIL PAN
2 SEALANT
KC0730-6A-M-RS

Figure 35 Applying Sealant to Oil Pan

2. Hoist vehicle.
3. Drain engine oil.

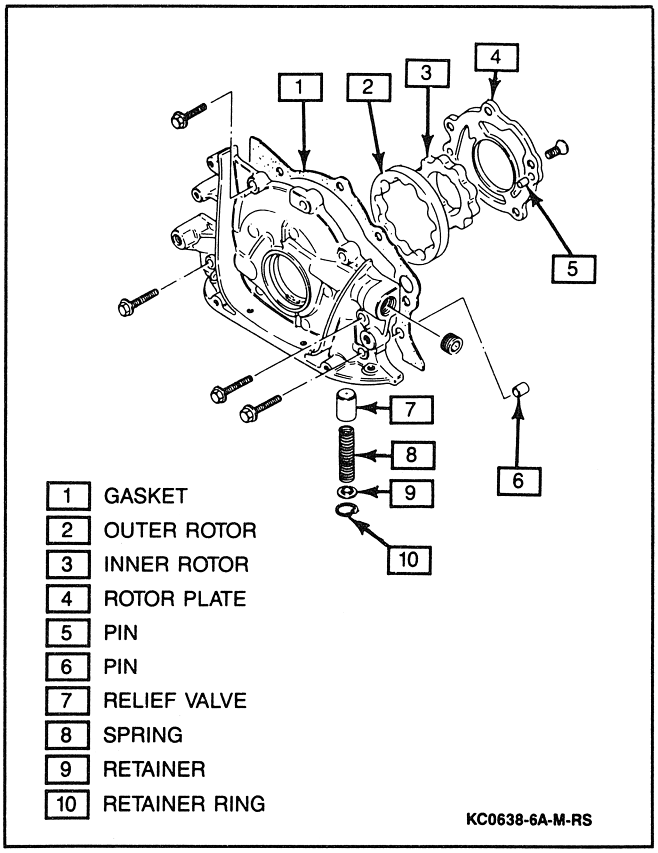

1
2
3
4
5
6
7
8
9
10
1 GASKET
2 OUTER ROTOR
3 INNER ROTOR
4 ROTOR PLATE
5 PIN
6 PIN
7 RELIEF VALVE
8 SPRING
9 RETAINER
10 RETAINER RING
KC0638-6A-M-RS

Figure 36 Oil Pump

4. Water pump belt, pulley, generator, generator bracket, and A/C mounting bracket, if equipped.
5. Crankshaft pulley, timing belt outside cover, timing belt, and tensioner as previously outlined.
6. Engine oil level gage.
7. Crankshaft timing belt gear and timing belt guide. With crankshaft locked, remove crankshaft timing belt pulley bolt (Figures 37 and 38).

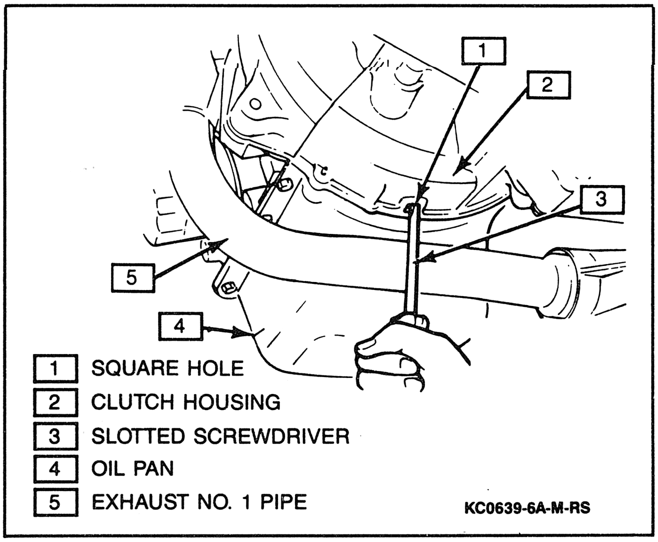

1
2
3
4
5
1 SQUARE HOLE
2 CLUTCH HOUSING
3 SLOTTED SCREWDRIVER
4 OIL PAN
5 EXHAUST NO. 1 PIPE
KC0639-6A-M-RS

Figure 37 Locking Crankshaft for M/T Model

8. Oil pan and oil pump strainer as previously outlined.

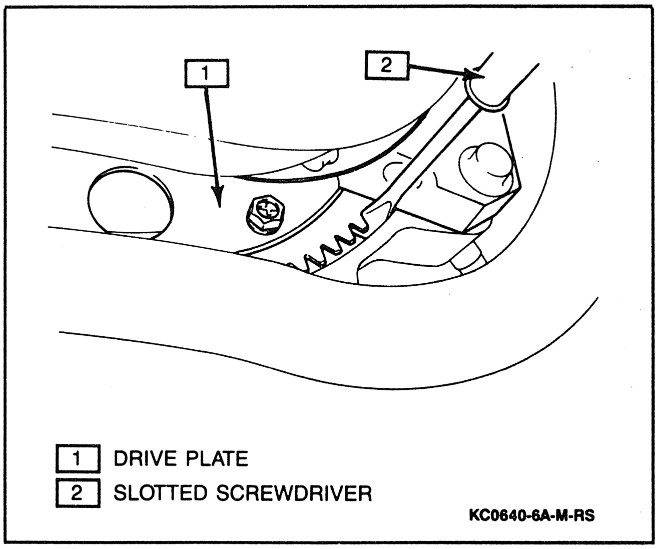

1
2
1 DRIVE PLATE
2 SLOTTED SCREWDRIVER
KC0640-6A-M-RS

Figure 38 Locking Crankshaft for A/T Model

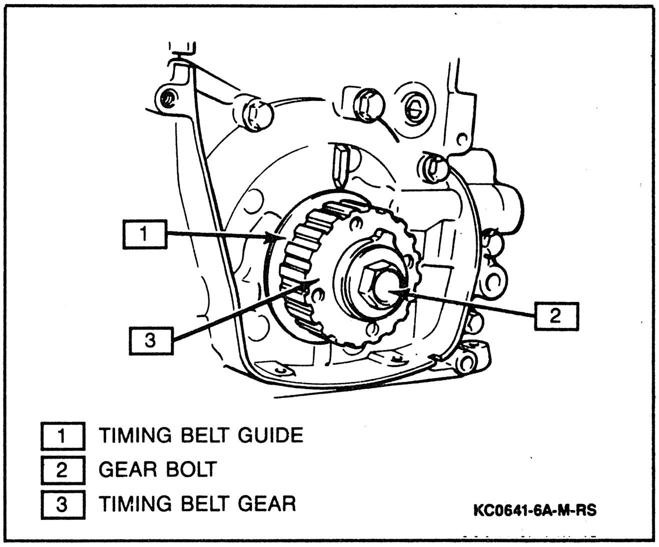

1
2
3
1 TIMING BELT GUIDE
2 GEAR BOLT
3 TIMING BELT GEAR
KC0641-6A-M-RS

Figure 39 Crankshaft Timing Belt Gear

9. Oil pump assembly after removing seven bolts securing pump (Figure 40).

Disassemble

1. Oil level gage guide from oil pump. After removing guide bolt, pull out guide from oil pump (Figure 41).
2. Rotor plate (Figure 42).
3. Outer rotor and inner rotor (Figure 43).

Inspect

- Oil seal lip for fault or other damage. Replace as necessary.
- Outer and inner rotors, rotor plate, and oil pump case for excessive wear or damage.

Measure

- Radial clearance between outer rotor and case, using thickness gage. If radial

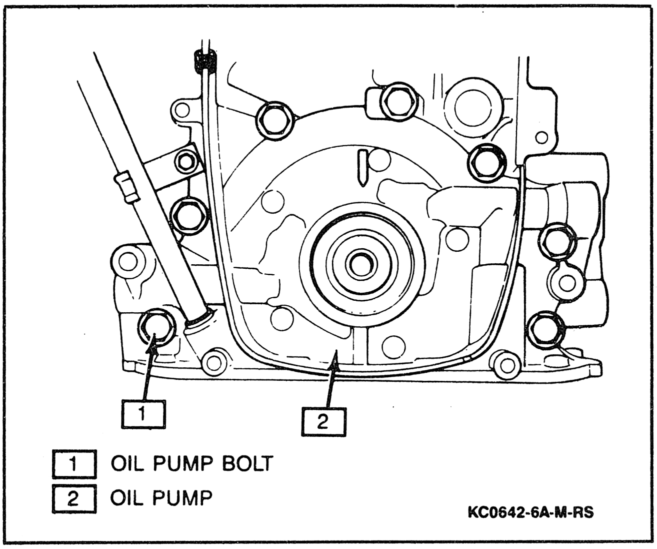

1
2
1 OIL PUMP BOLT
2 OIL PUMP
KC0642-6A-M-RS

Figure 40 Oil Pump Assembly

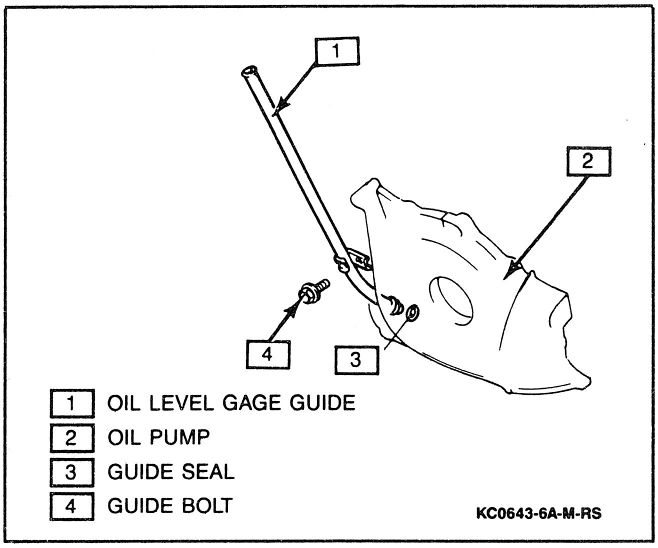

1
2
4
3
1 OIL LEVEL GAGE GUIDE
2 OIL PUMP
3 GUIDE SEAL
4 GUIDE BOLT
KC0643-6A-M-RS

Figure 41 Oil Level Gage Guide

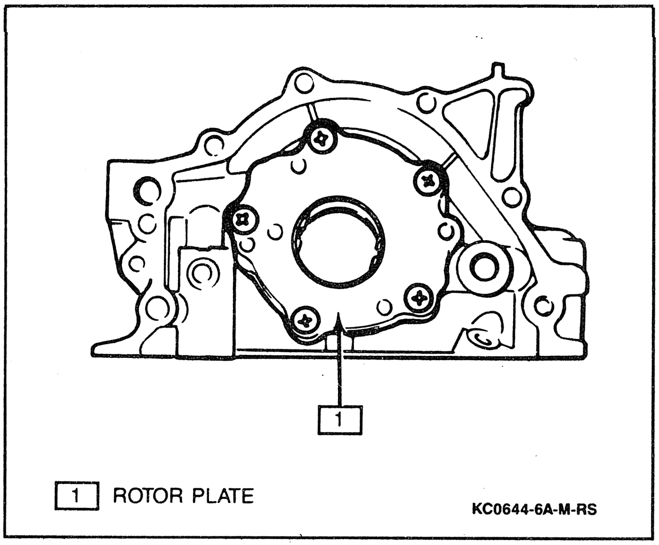

1
1 ROTOR PLATE
KC0644-6A-M-RS

Figure 42 Rotor Plate

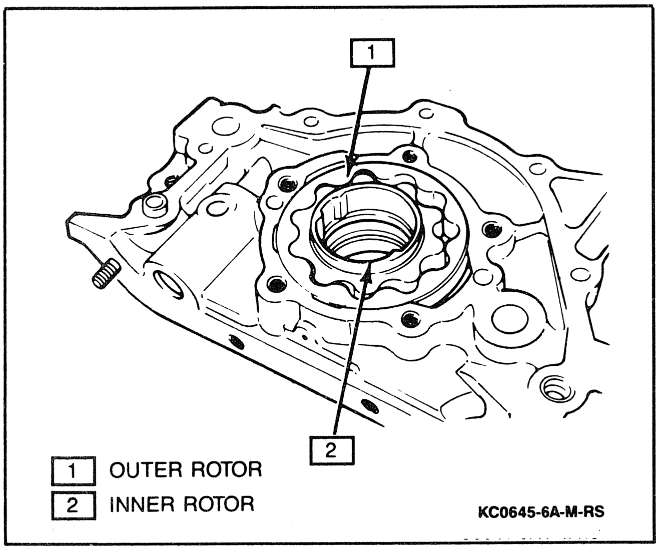

1
2
1 OUTER ROTOR
2 INNER ROTOR
KC0645-6A-M-RS

Figure 43 Outer Rotor and Inner Rotor

clearance exceeds its limit of .310 mm (0. 0122 in.), then replace the outer rotor or case (Figure 44).

- Side clearance using straight edge and thickness gage measure side clearance. The limit on side clearance is 0.15 mm (0.0059 in.) (Figure 45).

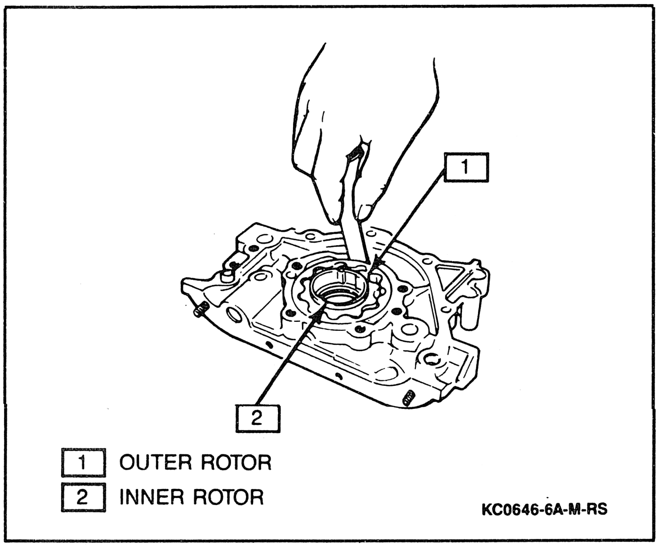

1
2
1 OUTER ROTOR
2 INNER ROTOR
KC0646-6A-M-RS

Figure 44 Measuring Radial Clearance

Assemble

1. Wash, clean, and dry all disassembled parts.
2. Apply thin coat of engine oil to inner and outer rotors, oil seal lip portion, and inside surfaces of oil pump case and plate.
3. Outer and inner rotors to pump case.
4. Rotor plate. Tighten five screws securely. After installing plate, check to be sure that gears turn smoothly by hand.
5. Guide seal to pump case and then oil level gage guide (Figure 41).

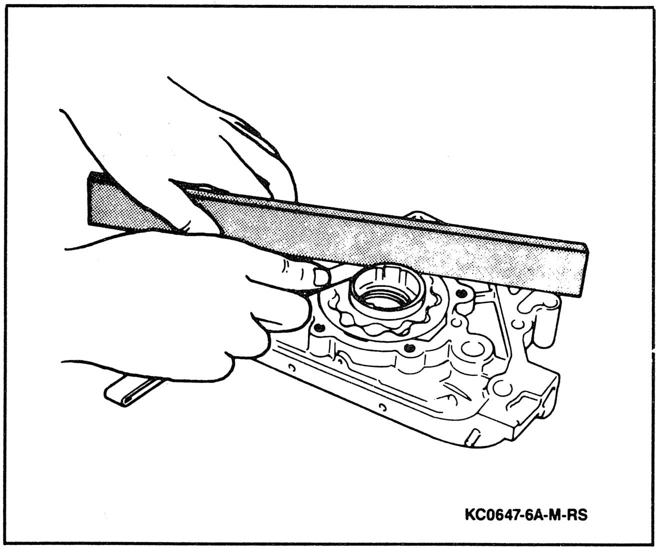

KC0647-6A-M-RS

Figure 45 Measuring Side Clearance

Install or Connect

1. Two oil pump pins and oil pump gasket to cylinder block.
2. To prevent oil seal lip from being damaged or upturned when installing oil pump to crankshaft, fit oil seal guide to crankshaft, and apply engine oil to oil seal guide.

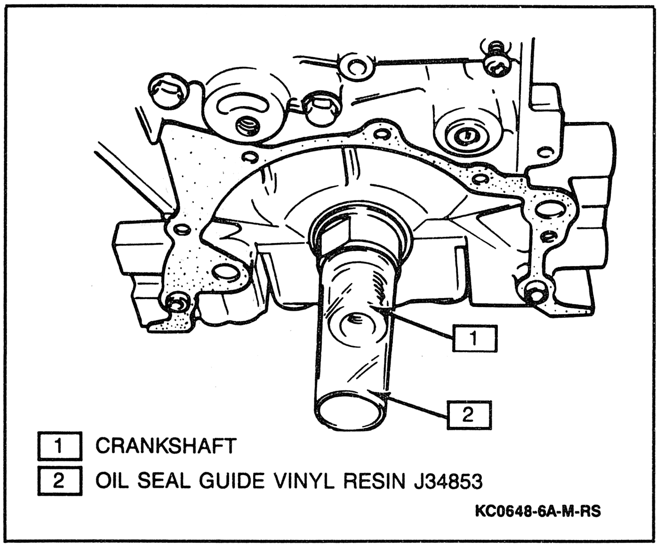

1
2
1 CRANKSHAFT
2 OIL SEAL GUIDE VINYL RESIN J34853
KC0648-6A-M-RS

Figure 46 Oil Seal Guide Installation

3. Oil pump to crankshaft and cylinder block: Among seven oil pump bolts, three No. 1 bolts and one No. 3 bolt are shorter than three No. 2 bolts in length. The thread of new No. 3 bolt is coated with sealant. Apply sealant to the thread of No. 3 bolt only when reusing. Install No. 1, No. 2 and No. 3 bolts in such arrangement (Figure 47), and tighten them to 11 N·m (8 lb.ft.). After installing oil pump, check to be sure that oil seal lip is not upturned, and then remove oil seal guide.
4. Rubber seal between oil pump and water pump.

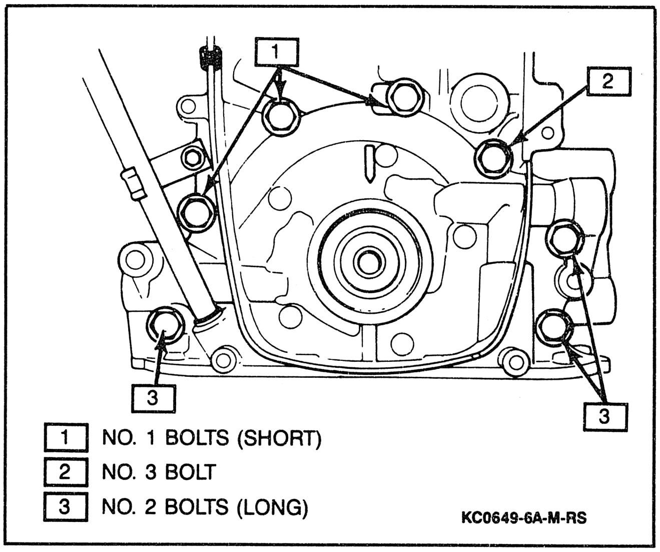

1
2
3
3
1 NO. 1 BOLTS (SHORT)
2 NO. 3 BOLT
3 NO. 2 BOLTS (LONG)
KC0649-6A-M-RS

Figure 47 Oil Pump Bolts

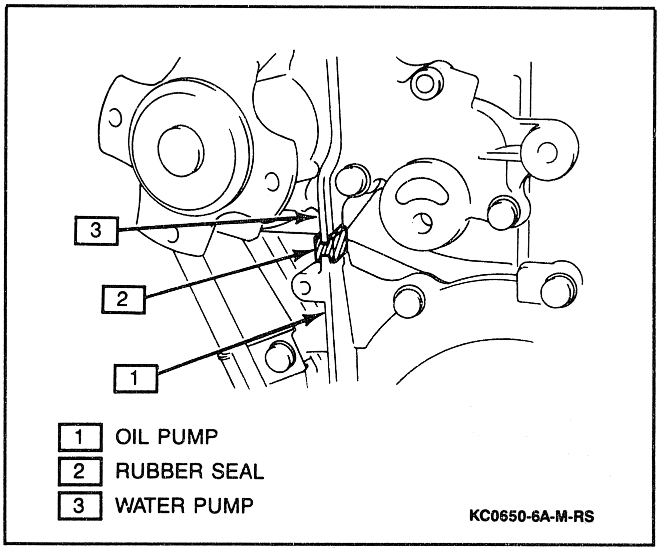

3
2
1
1 OIL PUMP
2 RUBBER SEAL
3 WATER PUMP
KC0650-6A-M-RS

Figure 48 Installing Rubber Seal

5. Edge of oil pump gasket might bulge out: if it does, cut bulge off with sharp knife, making edge smooth and flush with end faces of pump case and cylinder block.
6. Timing belt guide, key, and crankshaft timing belt gear. Install timing belt guide in such a way that its concave side faces oil pump. With crankshaft locked, tighten crankshaft timing belt gear bolt to 110 N·m (81 lb.ft.) (Figure 50).
7. Timing belt, tensioner, and other parts as previously outlined.
8. Adjust water pump belt tension.
9. Refill engine oil.
10. Negative battery cable.
11. After completing installation, check oil pressure by running engine.

OIL PRESSURE CHECK

Prior to checking the oil pressure, check the following:

- Oil level in oil pan. If the level is low add oil up to FULL level hole on oil level gage.

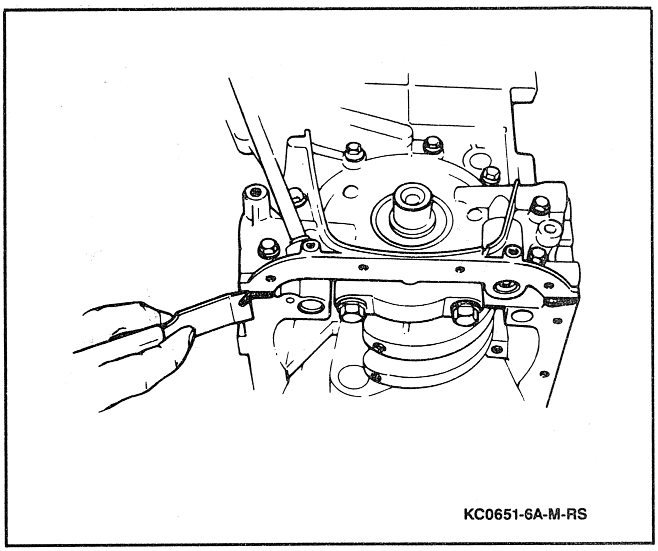

KC0651-6A-M-RS

Figure 49 Cutting Edge of Gasket

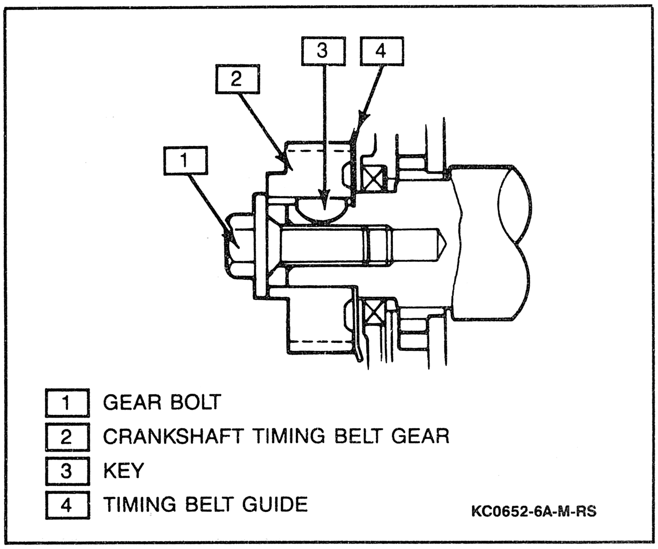

1 GEAR BOLT
2 CRANKSHAFT TIMING BELT GEAR
3 KEY
4 TIMING BELT GUIDE
KC0652-6A-M-RS

Figure 50 Installing Guide, Key and Gear

- Oil quality. If the oil is discolored, or deteriorated, change the oil.
- Oil leaks. If leak is found, repair it.

Remove or Disconnect

1. Oil filter.
2. Oil pressure switch.

Install or Connect

1. Oil gage. 1 pressure gage.
2. Oil filter.

NOTICE:

- Run engine until normal operating temperature is obtained.
- Raise engine speed to 3,000 rpm and measure oil pressure, stop engine.

Remove or Disconnect

1. Oil filter.
2. Oil pressure gage.

Install or Connect

1. Coat threads of oil pressure switch with sealant #1052080 and tighten switch to 14 N·m (10 lb.ft.).
2. Oil filter.

NOTICE: Start engine and check filter and switch for oil leakage.

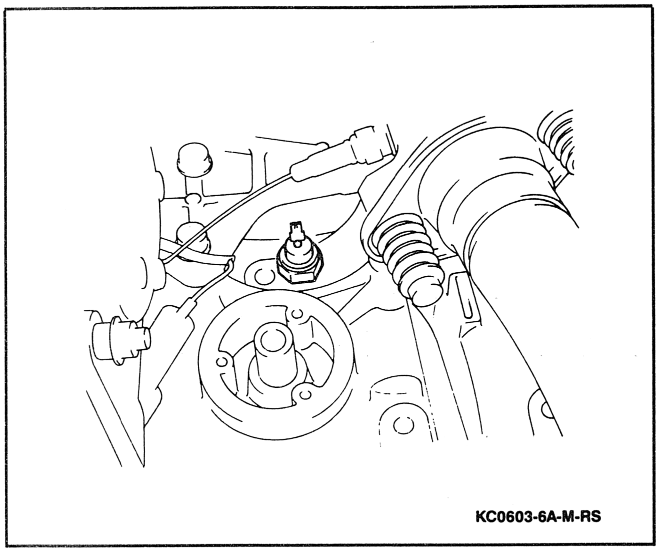

KC0603-6A-M-RS

Figure 51 Oil Pressure Switch

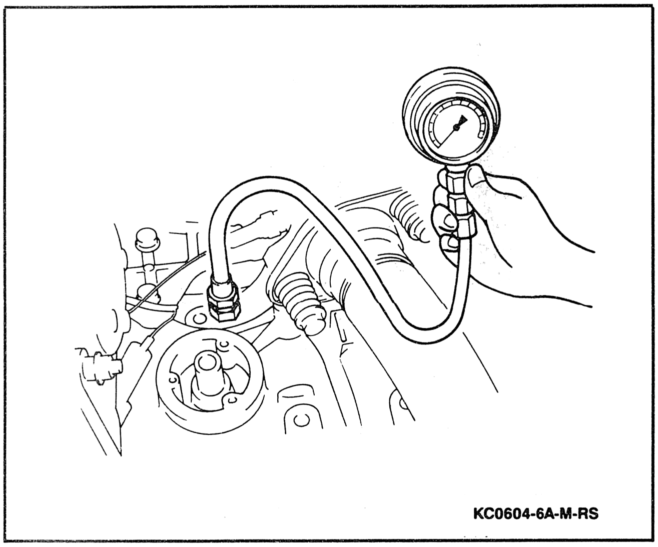

KC0604-6A-M-RS

Figure 52 Oil Pressure Gage Installation

CAMSHAFT AND HYDRAULIC VALVE LASH ADJUSTER

Valve Lash Adjuster

Remove or Disconnect

1. Negative battery cable.
2. Air cleaner assembly as previously outlined.
3. Cylinder head cover as previously outlined.

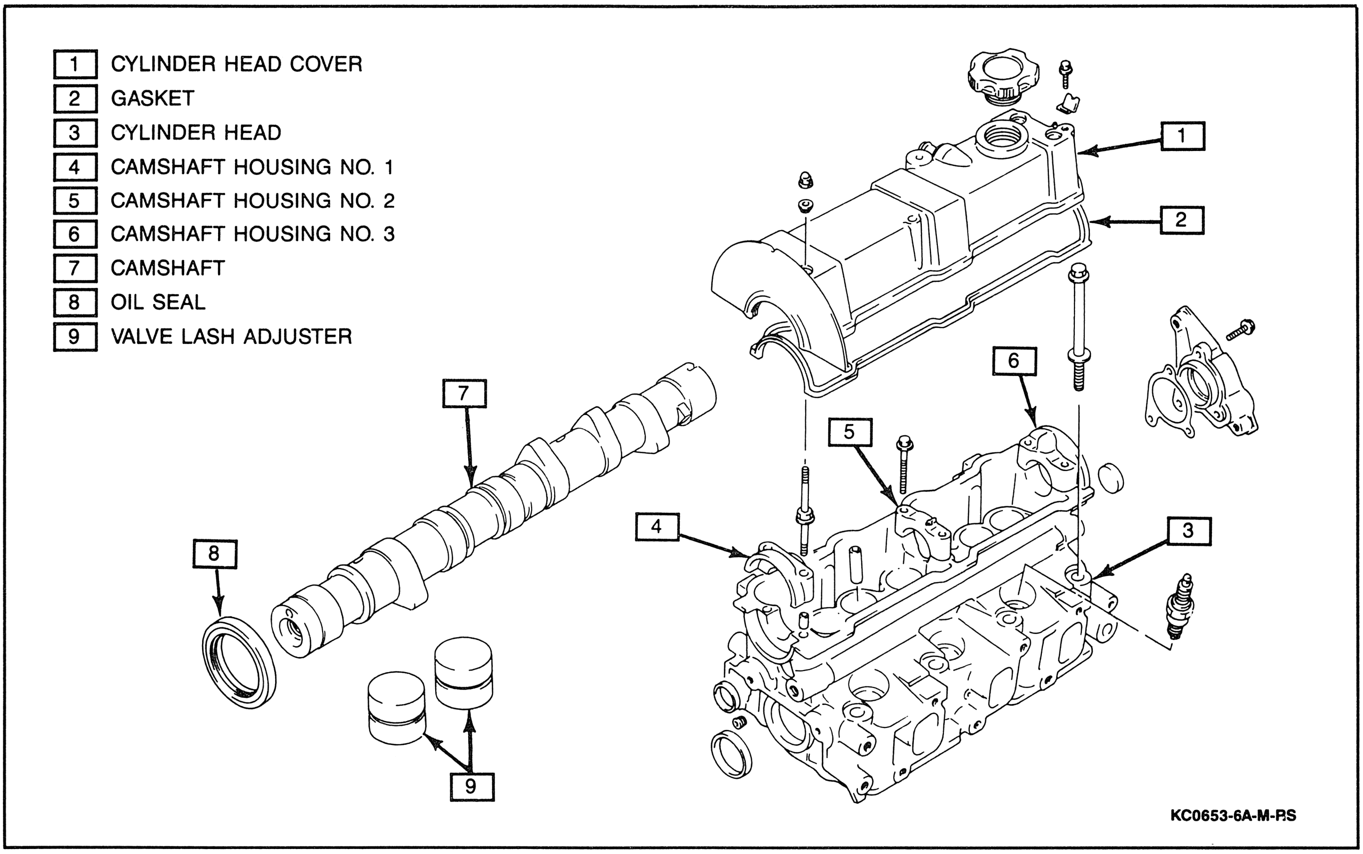

1 CYLINDER HEAD COVER
2 GASKET
3 CYLINDER HEAD
4 CAMSHAFT HOUSING NO. 1
5 CAMSHAFT HOUSING NO. 2
6 CAMSHAFT HOUSING NO. 3
7 CAMSHAFT
8 OIL SEAL
9 VALVE LASH ADJUSTER
1
2
3
4
5
6
7
8
9
KC0653-6A-M-RS

Figure 53 Camshaft, Camshaft Housing, and Valve

4. Distributor and the case from cylinder head.
5. Crankshaft pulley, timing belt outside cover and timing belt as previously outlined.

Important

- After removing timing belt, set key on crankshaft in position by turning crankshaft. This is to prevent interference between valves and piston when reinstalling camshaft (Figure 54).

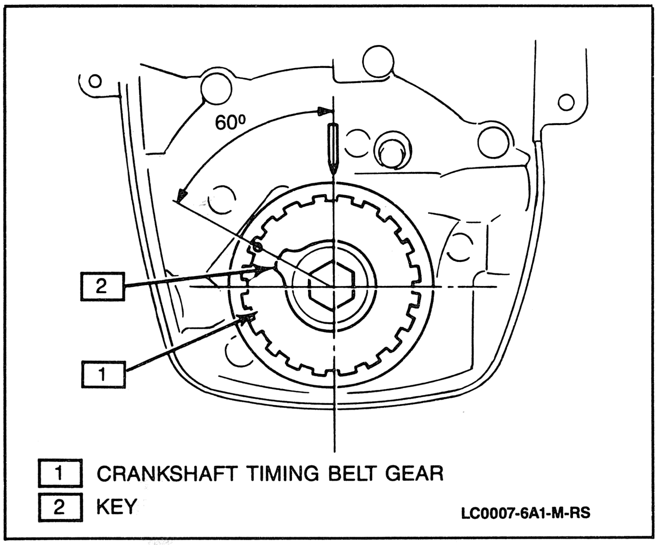

60°
2
1
1 CRANKSHAFT TIMING BELT GEAR
2 KEY
LC0007-6A1-M-RS

Figure 54 Position of Crankshaft Key

6. Camshaft timing belt gear. Lock camshaft with a proper size rod inserted into hole 10 mm, (0.39 in.) in it. Loosen camshaft timing belt gear bolt (Figure 55).

NOTICE: Mating surfaces of cylinder head and cover must not be damaged in this work. So, put clean shop cloth between rod and mating surfaces and use care not to bump rod against mating surfaces hard when loosening.

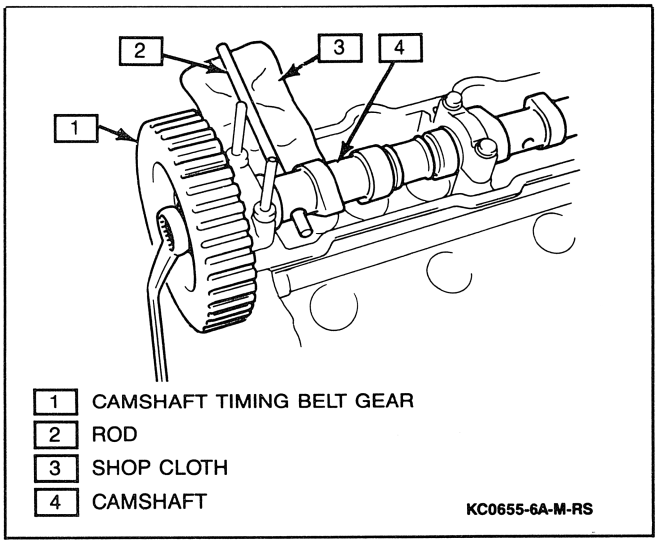

2
3
4
1
1 CAMSHAFT TIMING BELT GEAR
2 ROD
3 SHOP CLOTH
4 CAMSHAFT
KC0655-6A-M-RS

Figure 55 Loosening Gear Bolt

7. Camshaft housings from cylinder head.
8. Camshaft from cylinder head.
9. Valve lash adjuster from cylinder head.

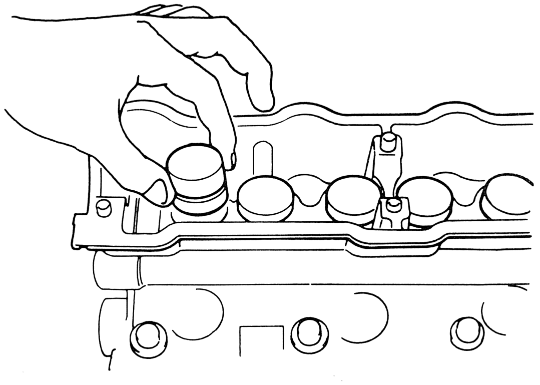


Figure 56 Removing Valve Lash Adjuster

NOTICE:

- Never disassemble hydraulic valve lash adjuster.
- Don't apply force to body of adjuster, or oil in high pressure chamber.
- Immerse removed adjuster in clean engine oil until reinstallation. If it is left in air, place it with its valve lash adjuster body facing down. Don't place on its side or with valve lash adjuster body facing up.

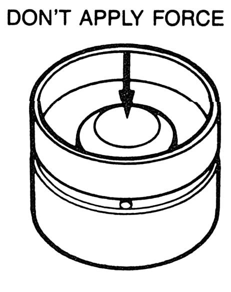


Figure 57 Valve Lash Adjuster

Inspect

- Cam wear using a micrometer. Measure height of cam. If measured height is below its limit, replace camshaft (Figure 59).

Camshaft Runout

Set camshaft between two "V" blocks, and measure its runout by using a dial gage. If measured runout exceeds it limit of 0.10 mm (0.0039 in.) replace camshaft (Figure 60).

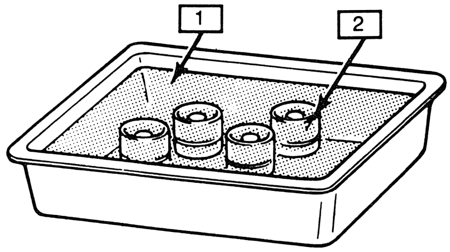


Figure 58 Storing Valve Lash Adjuster

		Standard	Limit
Intake & exhaust cam height	Other than METRO model	40.415 — 40.575 mm (1.5911 — 1.5974 in.)	40.315 mm (1.5873 in.)
	METRO model only	39.638 — 39.788 mm (1.5601 — 2.5664 in.)	39.528 mm (1.5562 in.)

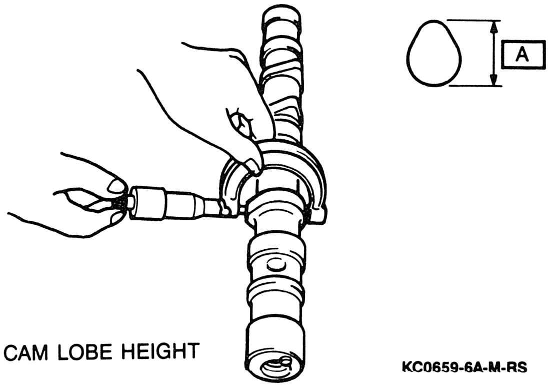


Figure 59 Measuring Cam Height

Camshaft Journal Wear

Check camshaft journals and camshaft housings, for pitting, scratches, wear or damage.

If any these conditions are found, replace camshaft or cylinder head without replacing housings.

Check clearance by using gaging plastic. The procedure as follows:

1. Clean housings and camshaft journals.
2. Make sure that all valve lash adjusters are removed and install camshaft to cylinder head.
3. Place a piece of gaging plastic the full width of journal of camshaft (parallel to camshaft).
4. Install housings (Figures 72 and 73) and evenly torque housing bolts to 11 N·m (8 lb.ft.). Housing MUST be torqued to specification in order to ensure proper reading of camshaft journal clearance.

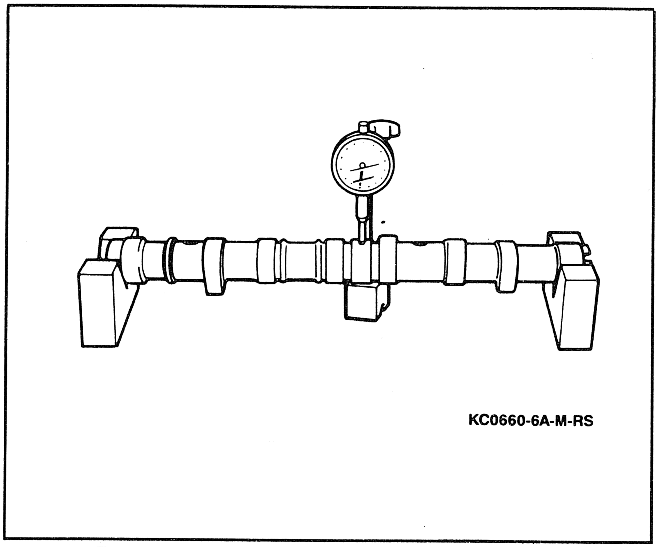


Figure 60 Measuring Camshaft Runout

NOTICE: Do not rotate camshaft while gaging plastic is installed.

5. Remove housing, and using scale on gaging plastic envelop, measure gaging plastic width at its widest point. The standard camshaft journal clearance is 0.020 - 0.062 mm (0.0008 - 0.0024 in.) If measured camshaft journal clearance exceeds its limit of 0.12 mm (0.0047 in.), measure journal (housing) bore and outside diameter of camshaft journal. Replace camshaft or cylinder head assembly, whichever the difference from specification is greater (Figures 61, 62, and 63).

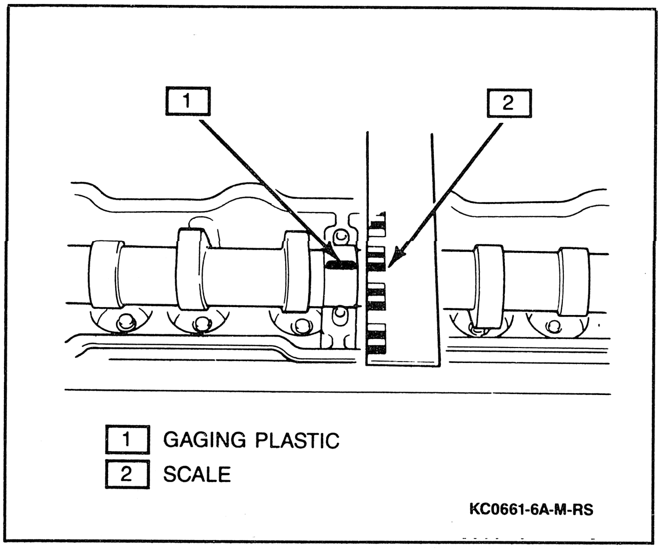


Figure 61 Measuring Camshaft Journal Clearance Diameter

Wear of Hydraulic Valve Lash Adjuster

Check adjuster for pitting, scratches, or damage. If any of these conditions are found, replace.

Measure cylinder head adjuster bore and adjuster outside diameter to determine cylinder head-to-adjuster clearance. If clearance exceeds limit, replace adjuster or cylinder head (Figures 65 and 66).

Item		Standard
Camshaft journal bore dia.	No. 1	26.000 — 26.021 mm (1.0236 — 1.0244 in).
	No. 2 & No. 3	30.000 — 30.021 mm (1.1811 — 1.1819 in.)
Camshaft journal O.D.	No. 1	25.959 — 25.980 mm (1.0220 — 1.0228 in.)
	No. 2 & No. 3	29.959 — 29.980 mm (1.1795 — 1.1803 in.)

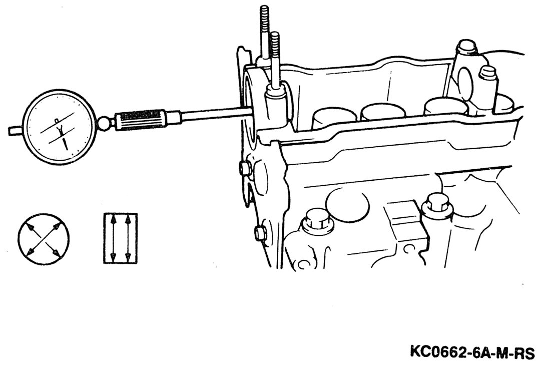


Figure 62 Measuring Journal Bore Diameter

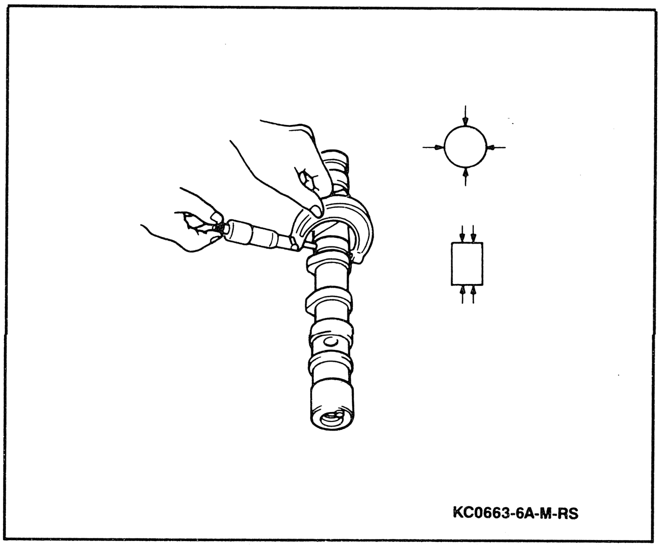


Figure 63 Measuring Camshaft Journal Diameter

→← Install or Connect

1. Before installing valve lash adjuster to cylinder head, fill oil passage of cylinder head with engine oil according to following procedure. Pour engine oil through camshaft journal oil holes and check that oil comes out from oil holes in sliding part of valve lash adjuster.
2. Valve lash adjuster to cylinder head. Apply engine oil around valve lash adjuster and then install it to cylinder head.
3. Camshaft to cylinder head. After applying engine oil to camshaft journal and all around cam,

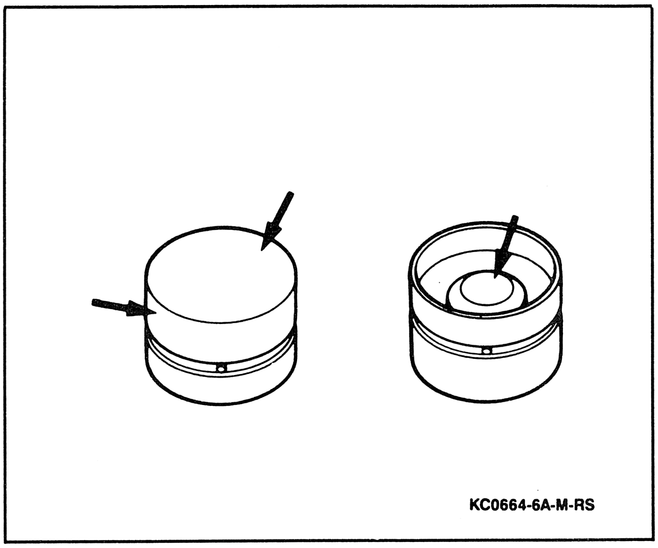


Figure 64 Checking Lash Adjuster

Item	Standard	Limit
Hydraulic valve lash adjuster O.D.	30.959 — 30.975 mm (1.2188 — 1.2194 in.)	—
Cylinder head bore	31.000 — 31.025 mm (1.2205 — 1.2214 in.)	—
Cylinder head to adjuster clearance	0.025 — 0.066 mm (0.0010 — 0.0025 in.)	0.15 mm (0.0059 in.)

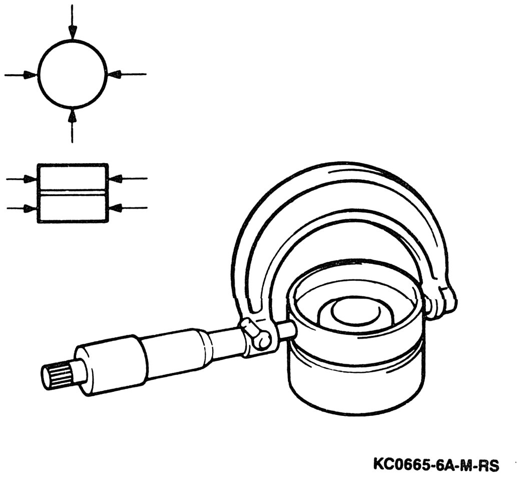


Figure 65 Measuring Valve Lash Adjuster Diameter

camshaft position into cylinder head so that camshaft timing belt gear pin hole in camshaft is at lower position.

4. Camshaft housing to camshaft and cylinder head.
   - Apply engine oil to sliding surface of each housing against camshaft journal.
   - Apply sealant to mating surface of No. 1 and No. 3 housings which will mate with cylinder head.
   - Marks are provided on each camshaft housing indicating position and direction for installation. Install housing as indicated by these marks (Figure 71).

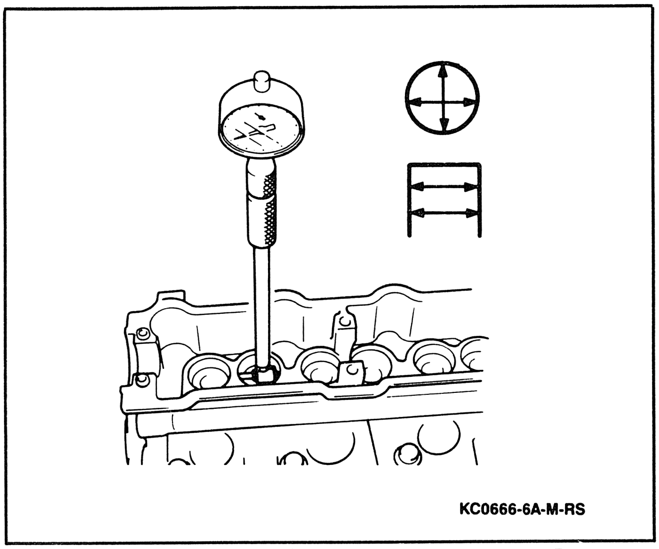


Figure 66 Measuring Cylinder Head Adjuster Bore

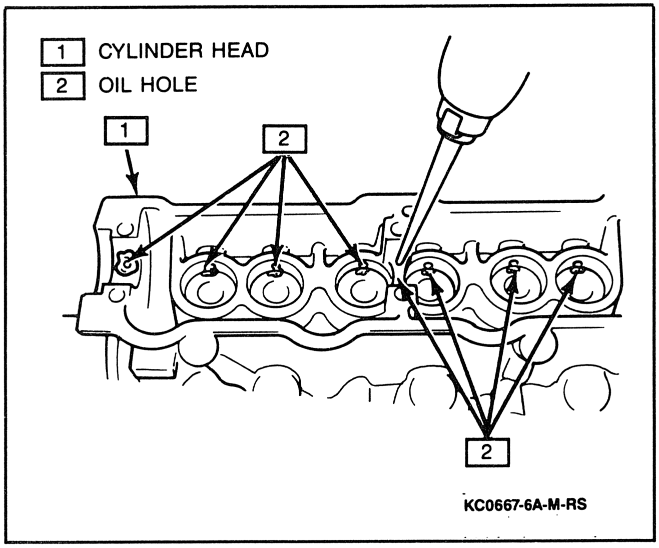


Figure 67 Pouring Engine Oil

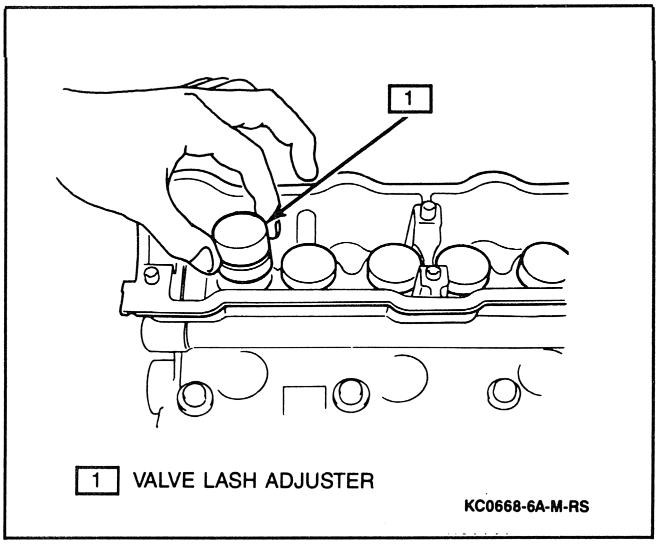


Figure 68 Installing Valve Lash Adjuster

   - As camshaft housing No. 1 retains camshaft in proper position as to thrust direction, make sure to first fit No. 1 housing to No. 1 journal of camshaft securely.

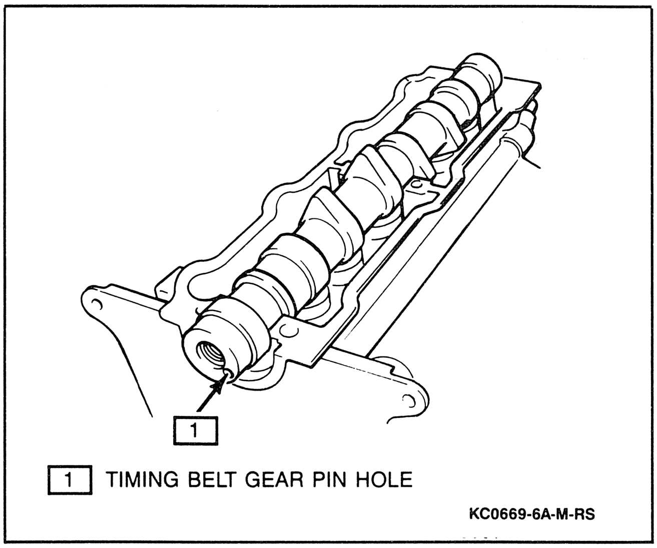

1
1 TIMING BELT GEAR PIN HOLE
KC0669-6A-M-RS

Figure 69 Installing Camshaft

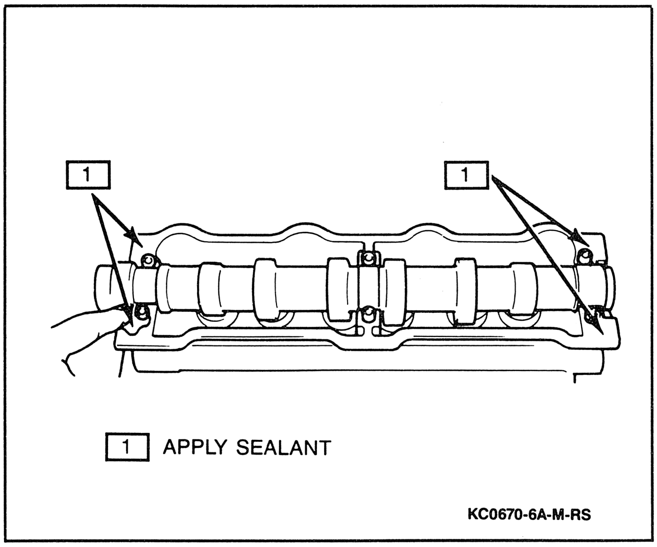

1
1
1 APPLY SEALANT
KC0670-6A-M-RS

Figure 70 Applying Sealant

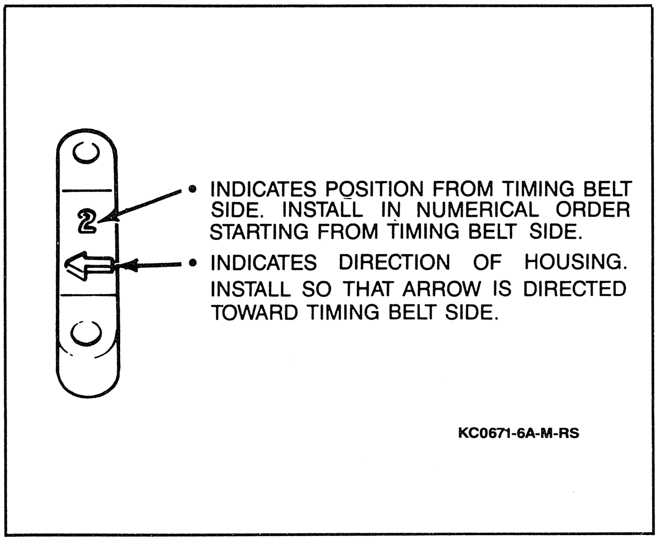

2
• INDICATES POSITION FROM TIMING BELT SIDE. INSTALL IN NUMERICAL ORDER STARTING FROM TIMING BELT SIDE.
• INDICATES DIRECTION OF HOUSING. INSTALL SO THAT ARROW IS DIRECTED TOWARD TIMING BELT SIDE.
KC0671-6A-M-RS

Figure 71 Camshaft Cap Marking

- After applying engine oil to housing bolts, tighten them temporarily. Then tighten them by following sequence as indicated in figure below. Tighten a little at a time and evenly among bolts, repeat tightening sequence three to four times before they are tightened to specified torque N•m (8 lb.ft.).

5. Camshaft oil seal. After applying engine oil to oil seal lip, press-fit camshaft oil seal till oil seal surface becomes flush with housing surface.
6. Camshaft timing belt gear to camshaft after installing dwell pin to camshaft. With locking camshaft (Figure 55).

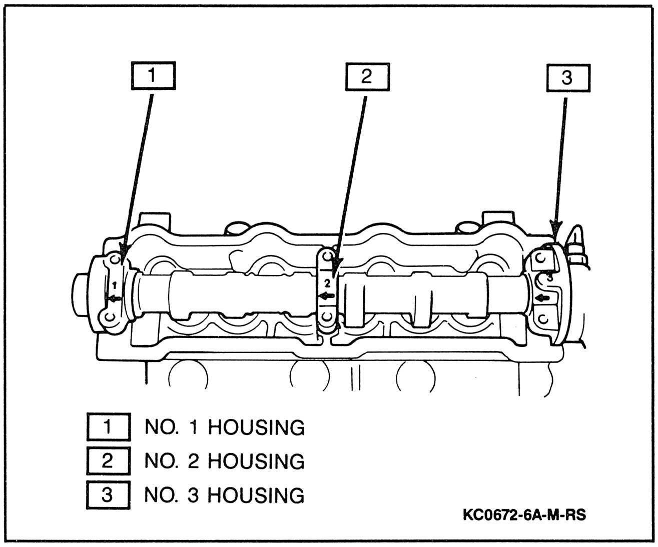

1
2
3
1 NO. 1 HOUSING
2 NO. 2 HOUSING
3 NO. 3 HOUSING
KC0672-6A-M-RS

Figure 72 Position of Housings

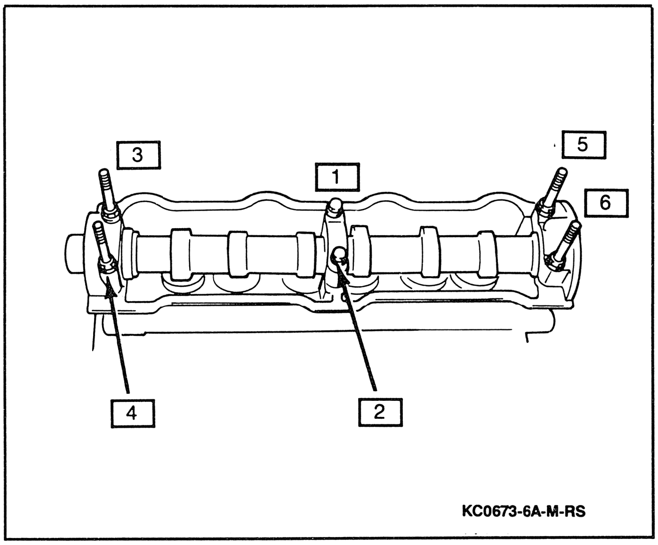

3
1
5
6
4
2
KC0673-6A-M-RS

Figure 73 Tightening Sequence of Housing Bolts

Tighten

- Pulley bolt to 60 N•m (44 lb.ft.).

7. Cylinder head cover to cylinder head as previously outlined.
8. Timing belt, timing belt outside cover, crankshaft pulley, water pump pulley and water pump belt.
9. Distributor case and distributor. Refer to Section 6E for installation.
10. Air cleaner assembly as previously outlined.
11. Negative battery cable.

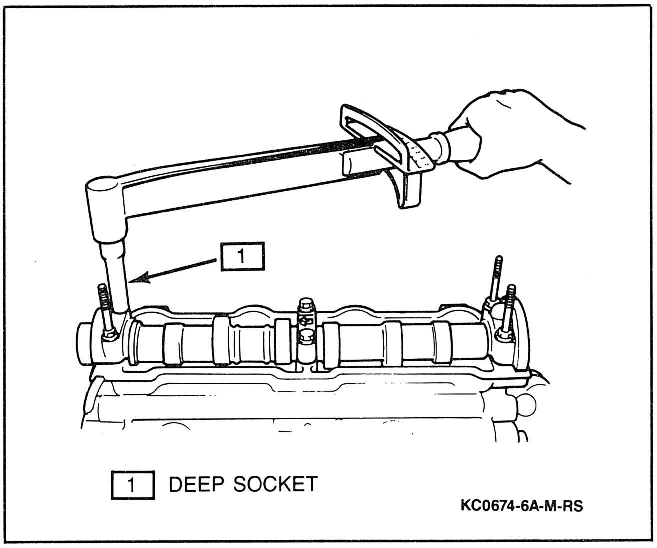


Figure 74 Tightening Housing Bolts

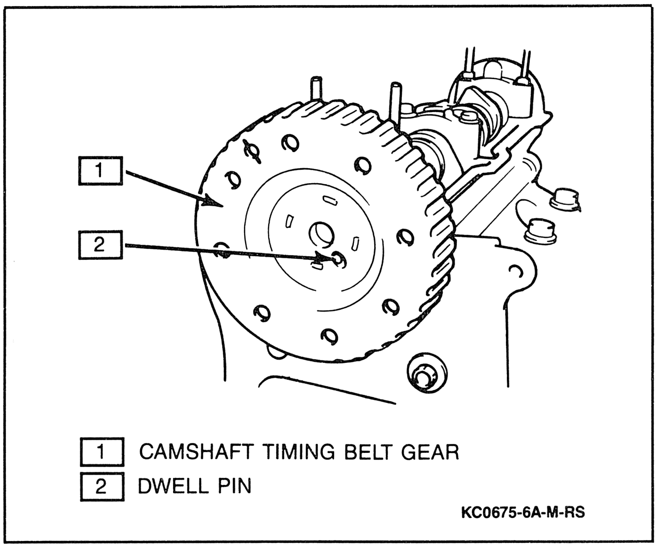


Figure 75 Installing Gear

12. Adjust ignition timing. Refer to Section 6E for adjustment.

NOTICE:

- Don't turn camshaft or start engine (i.e., valves should be operated) for about half an hour after reinstalling hydrualic valve lash adjusters and camshaft. As it takes time for valves to settle in place, operating engine within half an hour after their installation may cause interference to occur between valves and piston.
- If air is trapped in valve lash adjuster, valve may make tapping sound when engine is operated after valve lash adjuster is installed. In such a case, run engine for about half an hour at about 2,000 rpm, and then air will be purged and tapping sound will cease. Should tapping sound not cease, it is possible that valve lash adjuster is defective. Among the six of them, if defective adjuster can't be located, check as follows.

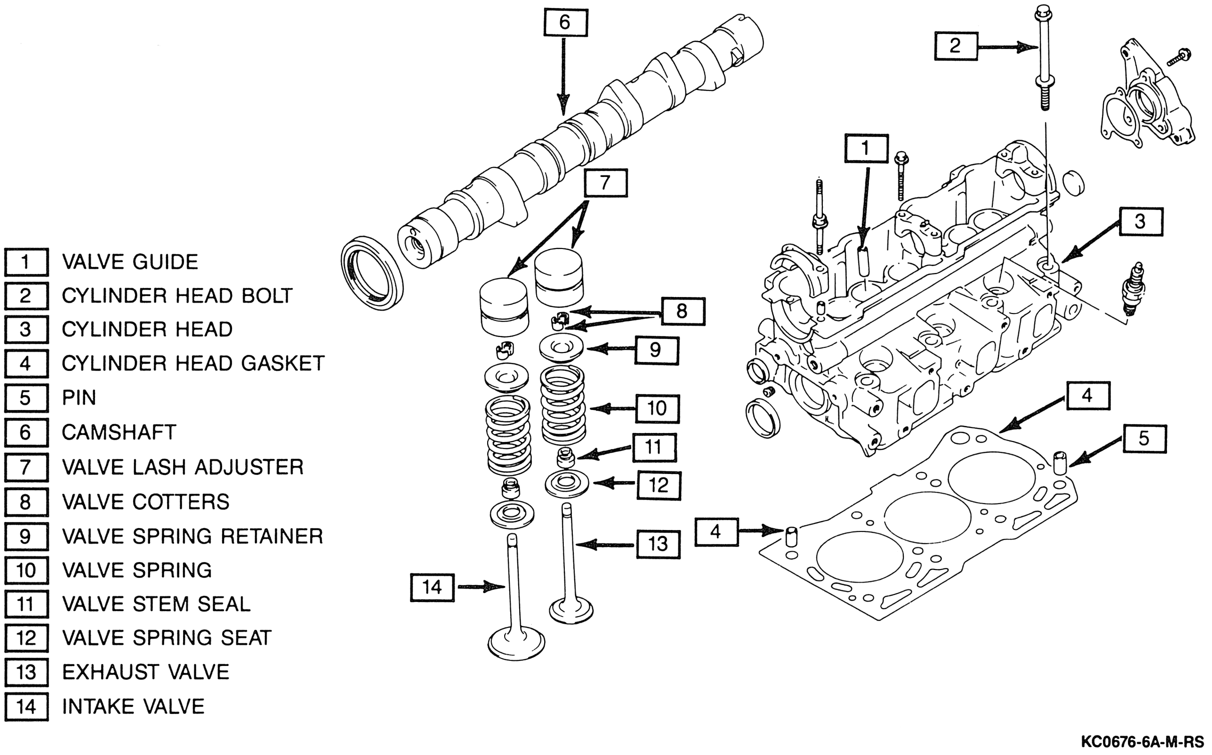
1. Stop engine and remove cylinder head cover.
2. Push adjuster downward by hand (with less than 15 kg or 33 lbs force) when cam lobe is not on adjuster to be checked and check if clearance exists between cam and adjuster. If it does, adjuster is defective and needs replacement.

VALVES AND CYLINDER HEAD

↔ Remove or Disconnect

1. Relieve fuel pressure according to procedure.
2. Negative battery cable.
3. Drain engine coolant.
4. Air cleaner assembly as previously outlined.
5. Following electric wire harness:
   - Center high tension wire from distributor.
   - Distributor.
   - Water temperature gage.
   - Radiator fan thermo switch.
   - Water temperature sensor.
   - Throttle switch or throttle position solenoid.
   - Fuel injector.
   - Vacuum switching valve for EGR valve.
   - Idle speed control solenoid valve.
   - Ground wires from intake manifold.
   - Oxygen sensor and release above wire harness from clamps.
6. Water hoses:
   - Heater inlet hose from intake manifold.
   - Throttle body outlet hose from throttle body.
   - Water outlet hose from thermostat cap.
7. Following vacuum hoses:
   - Pressure sensor hose from intake manifold.
   - Canister hose from its pipe.
   - Canister purge hose from intake manifold.
   - Brake booster hose from intake manifold.
8. Fuel return hose and fuel feed hose from throttle body.
9. Accelerator cable from throttle body.
10. Hoist car.
11. Exhaust No. 1 pipe from exhaust manifold.
12. Cylinder head cover.
13. Cylinder head bolts. Cylinder head with throttle body, intake manifold and exhaust manifold.

NOTICE: With camshaft still mounted to cylinder head, one of six valves is out toward combustion chamber (i.e. it is open). Be sure NOT to place cylinder head on any flat surface with its mating surface with cylinder block facing down. It will cause damage to such open valve.

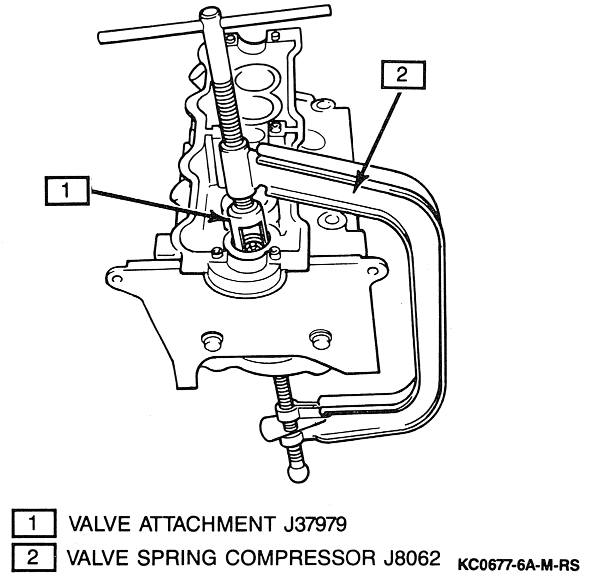


1 VALVE GUIDE
2 CYLINDER HEAD BOLT
3 CYLINDER HEAD
4 CYLINDER HEAD GASKET
5 PIN
6 CAMSHAFT
7 VALVE LASH ADJUSTER
8 VALVE COTTERS
9 VALVE SPRING RETAINER
10 VALVE SPRING
11 VALVE STEM SEAL
12 VALVE SPRING SEAT
13 EXHAUST VALVE
14 INTAKE VALVE
KC0676-6A-M-RS

Figure 76 Cylinder Head, Valve, Valve Spring, Valve Guide

Disassemble

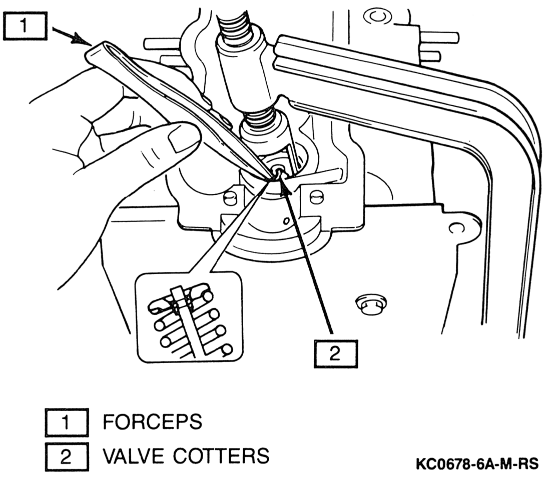
1. For ease in servicing cylinder head, remove intake manifold with throttle body, exhaust manifold and distributor from cylinder head.
2. Remove camshaft and valve lash adjusters from cylinder head.
3. Using valve compressor J 8062, compress valve springs and then remove valve keepers by using forceps.



1 VALVE ATTACHMENT J37979
2 VALVE SPRING COMPRESSOR J8062
KC0677-6A-M-RS

Figure 77 Install Valve Lifter

4. Release valve compressor, and remove spring retainer and valve spring.



1 FORCEPS
2 VALVE COTTERS
KC0678-6A-M-RS

Figure 78 Forceps and Valve Cotters

5. Remove valve from combustion chamber side.
6. Remove valve stem from valve guide, and valve spring seat.

NOTICE: Do not reuse seal once disassembled. Be sure to use new seal when assembling.

7. Using valve guide remover J 37968-1, drive valve guide out from combustion chamber side to valve spring side.

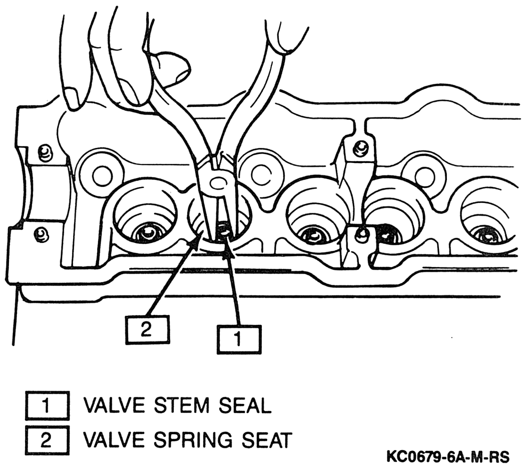


Figure 79 Removing Valve Stem Seal

NOTICE: Do not reuse valve guide once disassembled. Be sure to use new valve guide (Oversize) when assembling.

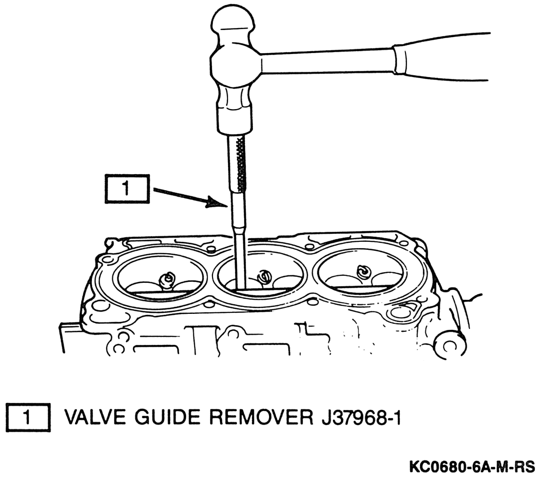


Figure 80 Removing Valve Guide

8. Place disassembled parts except valve stem seal and valve guide in order so that they can be installed in their original positions.

Inspect

Valve Guides

Using a micrometer and bore gage, take diameter readings on valve stems and guides to check stem-to-guide clearance. Be sure to take reading at more than one place along the length of each stem and guide. If clearance exceeds limit, replace valve and valve guide (Figure 81).

Valves

- Remove all carbon from valves.

Item		Standard	Limit
Valve stem diameter	In	5.457 — 5.480 mm (0.2148 — 0.2157 in.)	—
	Ex	5.450 — 5.465mm (0.2146 — 0.2151 in.)	—
Valve guide I.D.	In & Ex	5.500 — 5.512 mm (0.2165 — 0.2170 in.)	—
Stem-to-guide clearance	In	0.020 — 0.055 mm (0.0008 — 0.0021 in.)	0.07 mm (0.0027 in.)
	Ex	0.035 — 0.062 mm (0.0014 — 0.0024 in.)	0.09 mm (0.0035 in.)

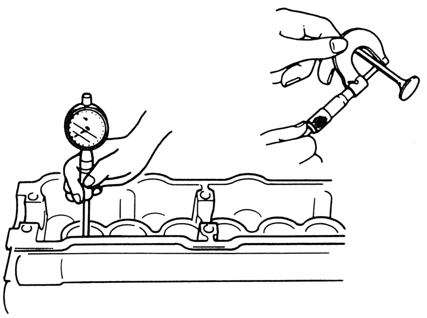


Figure 81 Measuring Valve Stem Diameter and

- Inspect each valve for wear, burn or distortion at its face and stem and, replace as necessary.
- Measure thickness of valve head. If measured thickness exceeds limit, replace valve. The standard valve head thickness for intake valves is 1.0 mm (0.039 in.) and the limit is 0.6 mm (0.023 in.). The standard valve head thickness for exhaust valves is 1.2 mm (0.047 in.) and the limit is 0.7 mm (0.027 in.).
- Inspect valve stem end face for pitting and wear. If pitting or wear is found, valve stem end may be resurfaced, replace valve if chamfer area is excessively worn.
- Check each valve for radial runout with a dial gauge and "V" block. To check runout, rotate valve slowly. If measured runout exceeds limit of 0.08 mm (0.003 in.), replace valve.

Seating Contact Width

Produce a contact pattern on each valve in the usual manner, that is, by giving a uniform coat of Red-lead past to valve seat and by rotatingly tapping each seat with valve head.

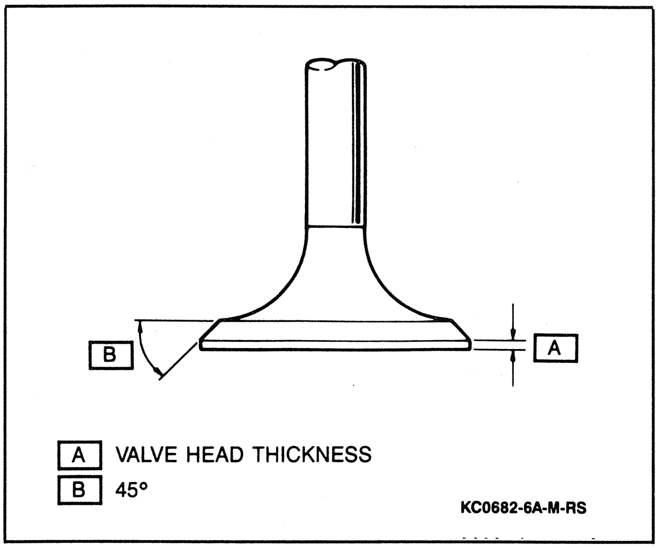

B
A
A VALVE HEAD THICKNESS
B 45°
KC0682-6A-M-RS

Figure 82 Valve Head Thickness

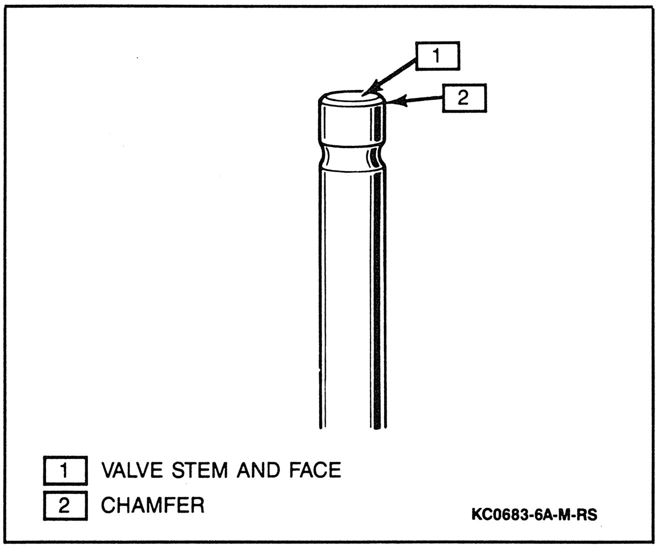

1
2
1 VALVE STEM AND FACE
2 CHAMFER
KC0683-6A-M-RS

Figure 83 Valve Stem End Face

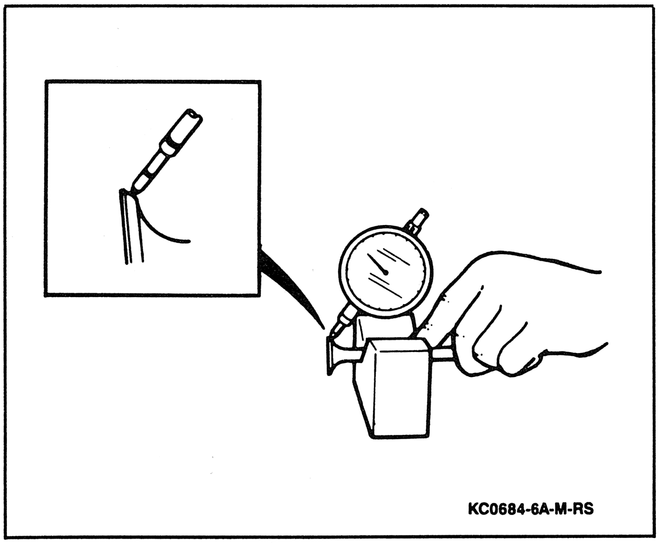

KC0684-6A-M-RS

Figure 84 Measuring Radial Runout

The valve lapper (a suction cup holding device) should be used.

The pattern produced on seating face of each valve must be a continuous ring without any break and width of pattern must be within specification 1.3 - 1.5 mm (0.0512 - 0.0590 in.), for both intake and exhaust valves.

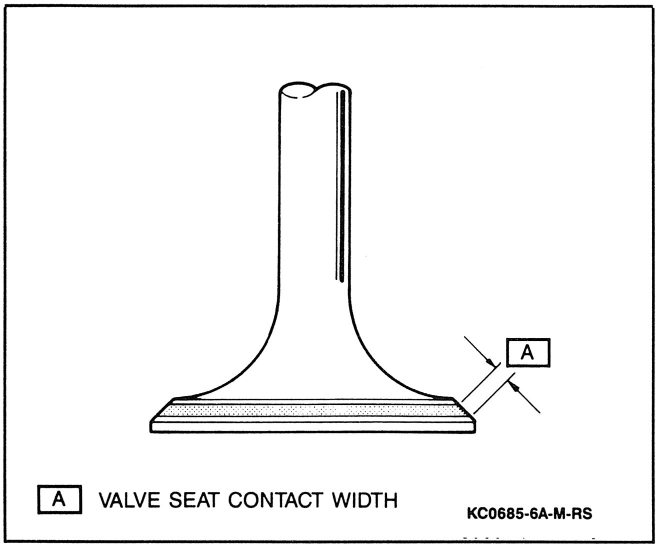

A
A VALVE SEAT CONTACT WIDTH
KC0685-6A-M-RS

Figure 85 Valve Seating Contact Width

Valve Seat Repair

A valve seat not producing a uniform contact with its valve or showing seating contact that is off the specified width must be repaired by regrinding finish by lapping.

The valve seat for both the intake and exhaust valves are machined to two different angles. The seat contact surface is cut 45° and the area above the contact surface (closest to the combustion chamber) is cut to 15°.

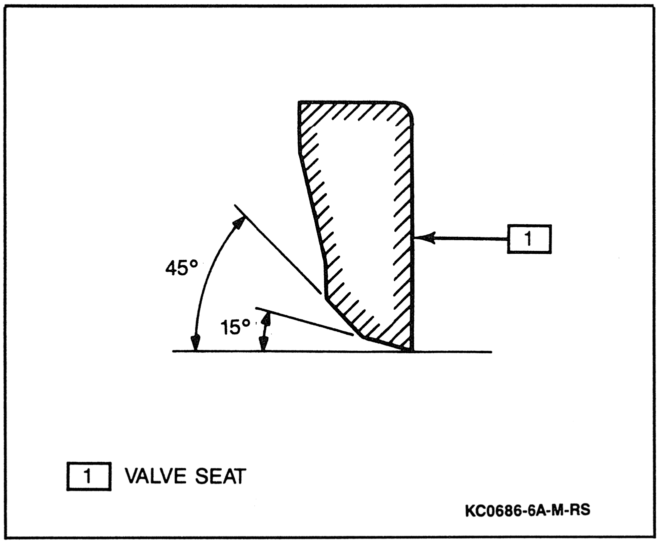

45°
15°
1
1 VALVE SEAT
KC0686-6A-M-RS

Figure 86 Valve Seat Angle

1. Using a 45° valve seat cutter, descale and clean up the seat with one or two turns.
2. Inspect seat by previously described seat width measurement procedure. If seat is pitted or burned, additional seat conditioning with 45° cutter is required.

NOTICE: Cut only the minimum amount necessary from the seat to prevent possibility of valve stem becoming to close to cam.

If contact area is too wide, use a 15° valve seat cutter to make it narrower.

If contact area is too narrow, use the 45° valve seat cutter to widen it.

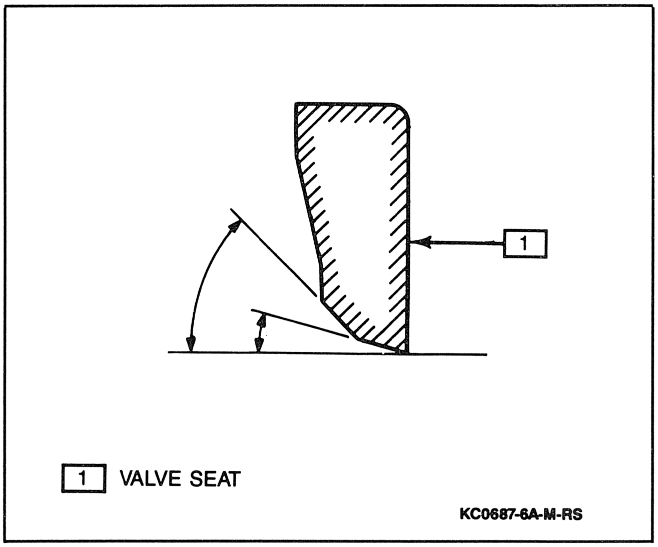


Figure 87 Cutting Valve Seat

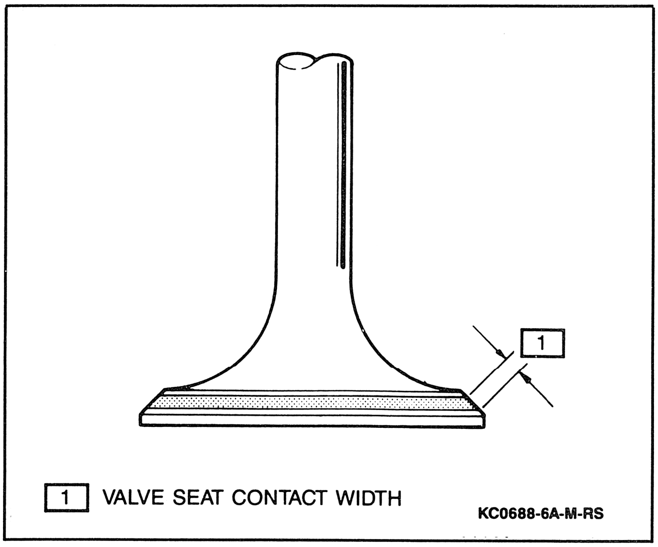


Figure 88 Valve Seating Contact Width

3. After desired seat width is achieved, lap valve on seat in two steps, first with a coarse size lapping compound applied to its face and secondly with a fine-size compound, each time using a valve lapper according to the usual lapping method.

Cylinder Head

- Remove all carbon from combustion chambers.

NOTICE: Do not use any sharp-edged tool to scrape off carbon. Be careful not to scuff or nick the metal surfaces when decarboning. The same applies to valves and valve seats, too.

- Check cylinder head for cracks in intake and exhaust ports, combustion chambers, and head surface.
- Flatness of gasket surface: Using a straightedge and thickness gage, check surface at a total of six locations. If distortion exceeds the 0.05 mm (0. 002 in.), correct gasket surface with a surface plate and abrasive paper of about #400 (Waterproof silicon carbide abrasive paper), place paper on and over surface plate, and rub gasket surface against paper to grind off high spots. Should this fail to reduce thickness gage readings to within the limit, replace cylinder head. Leakage of combustion gases from this gasket joint is often due to a warped gasket surface; such leakage results in reduced power output (Figures 89 and 90).

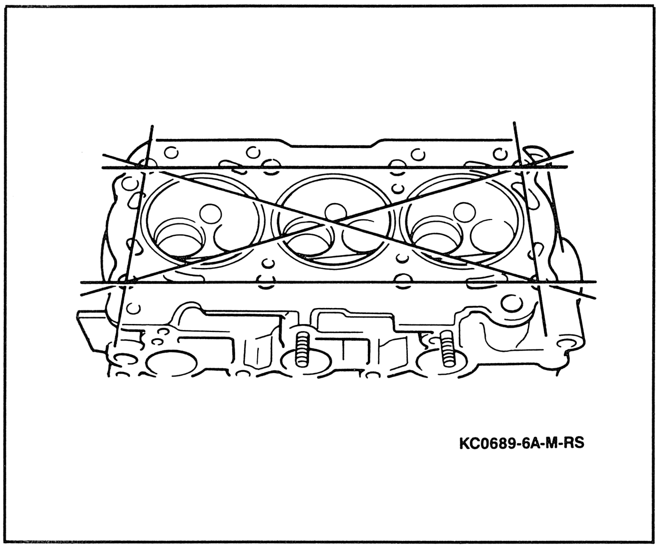


Figure 89 Location for Measurement of Distortion

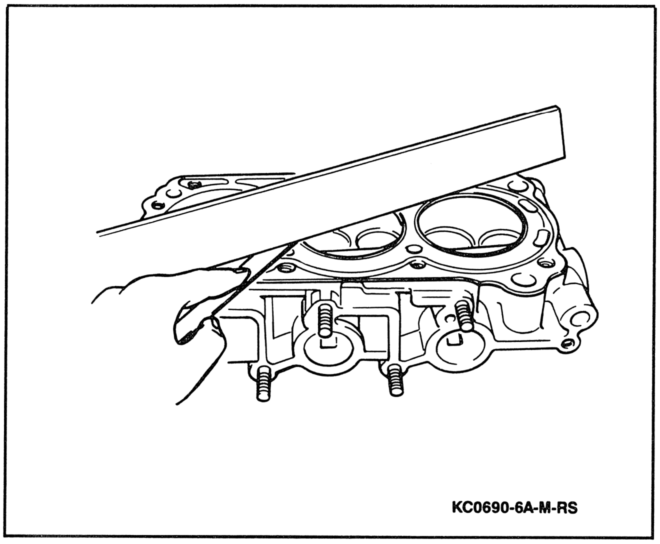


Figure 90 Measuring Surface

- Distortion of manifold seating faces:

Check seating faces of cylinder head for manifolds, using a straightedge and thickness gage, in order to determine whether these faces should be corrected or cylinder head replaced. If measurements after any correction exceeds the 0.10 mm (0.004 in.) limit, replace cylinder head.

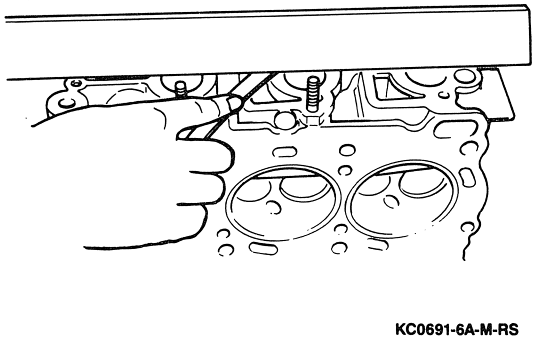


Figure 91 Measuring Surface of Intake Manifold Seating Face

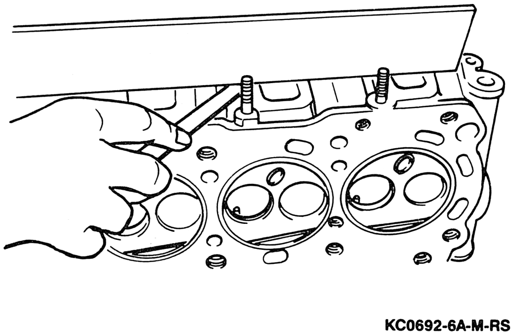


Figure 92 Measuring Surface of Exhaust Manifold Seating Face

Valve Springs

- Referring to data given in next column, check to be sure that each spring is in sound condition, free of any evidence of breakage or weakening. Remember, weakened valve springs can cause chatter, not to mention possibility of reducing power output due to gas leakage caused by decreased seating pressure (Figure 93 and 94).

- Spring squareness:

Use a square and surface plate to check each spring for squareness in terms of clearance between end of valve spring and square. Valve springs found to exhibit a larger clearance than 2.0 mm (.079 in.) must be replaced (Figure 95).

Item	Standard	Limit
Valve spring free length	40.73 mm (1.6035 in.)	39.5 mm (1.5551 in.)
Valve spring preload	18.6 — 21.4 kg at 32.6 mm (41.0 — 47.2 lb at 1.28 in.)	16.6 kg at 32.6 mm (36.6 lb at 1.28 in.)

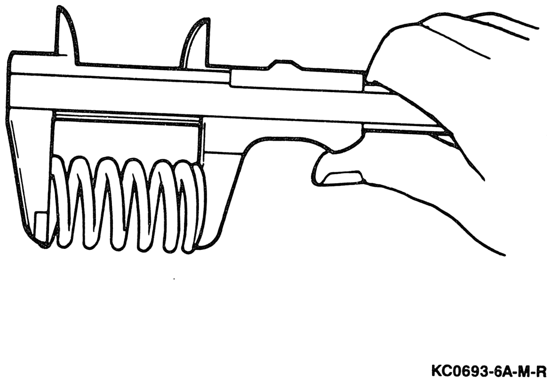


Figure 93 Measuring Free Length of Spring

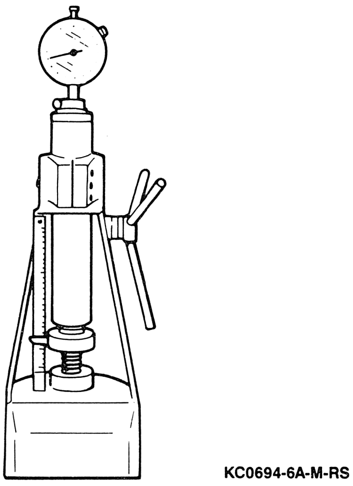


Figure 94 Measuring Spring Preload

Assemble

1. Before installing valve guide into cylinder head, ream guide hole with J 37972 (11 mm reamer) to remove burrs and make round.

2. Valve guide to cylinder head. Heat cylinder head uniformly at a temperature of 80° to 100°C (176 to 212°F) so that head. will not be distorted, and drive new valve guide into hole with special tools. Refer to (Figure 97). Drive in new valve guide until special tool (Valve guide installer) contacts cylinder head. After installing, make sure that

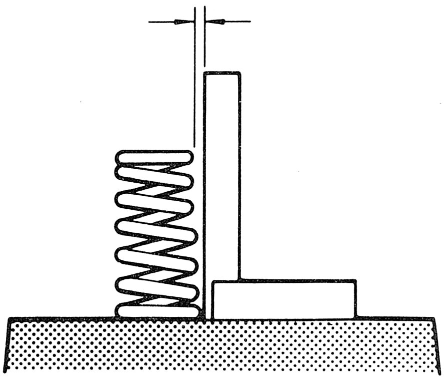
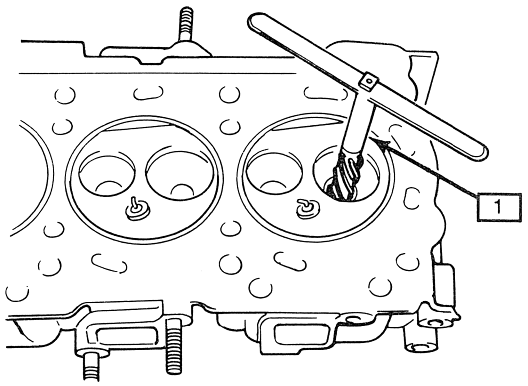


Figure 95 Measuring Spring Squareness

valve guide protrudes by 11.5 mm (0.45 in.) from cylinder head.

NOTICE:

- Do not reuse valve guide once disassembled. Install new valve guide (Oversize).
- Intake and exhaust valve guides are identical.



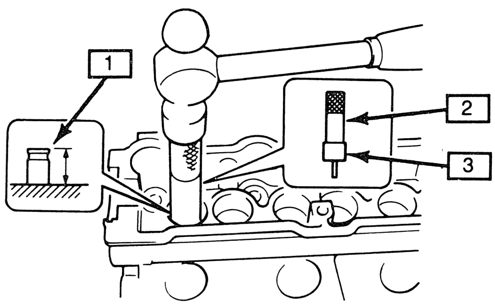
1 11 mm REAMER J37972

Figure 96 Reaming Guide Hole

3. Ream valve guide bore with J 37971 (5.5 mm reamer). After reaming, clean the bore.
4. Valve spring seat to cylinder head.
5. New valve stem to valve guide. After applying engine oil to seal and spindle of valve guide installer handle fit oil seal to spindle, and then install seal to valve guide by pushing tool J 37968-1 by hand. After installing, check to be sure that seal is properly fixed to valve guide.

NOTICE:

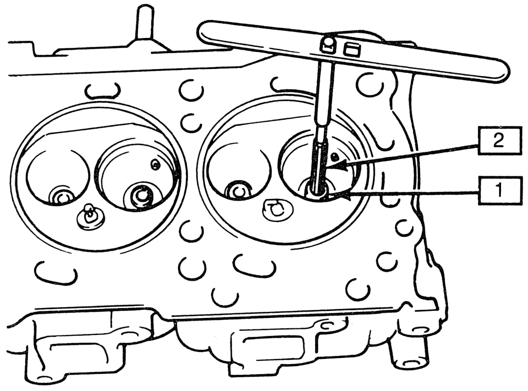
- Do not reuse seal once disassembled. Be sure to install new seal.



Valve guide oversize	0.03 mm (0.0012 in.)
Valve guide protusion (In and Ex)	11.5 mm (0.45 in.)

1 VALVE GUIDE INSTALLER ATTACHMENT J37968-2
2 VALVE GUIDE INSTALLER HANDLE J37968-1
3 VALVE GUIDE PROTRUSION (11.5 mm, 0.45 in.)

Figure 97 Installing Valve Guide



1 VALVE GUIDE
2 5.5 mm REAMER J

Figure 98 Reaming Valve Guide Bore

- When installing, never tap or hit tool J 37968-1 with a hammer. Install seal to guide only by pushing tool J 37968-1 by hand. Tapping or hitting tool may cause damage to seal.

6. Valve to valve guide. Before installing valve to valve guide, apply engine oil to stem seal, valve guide bore, and valve stem.
7. Valve spring and spring retainer. Each valve spring has top end (large-pitch end) and bottom end (small-pitch end). Be sure to position spring in place with its bottom end (small-pitch end) facing the bottom (valve spring seat side).
8. Using valve compressor J 8062, compress valve and fit two valve keepers into groove provided on the valve stem.
9. Valve lash adjuster and camshaft previously outlined.
10. Intake manifold with throttle body, exhaust manifold and distributor to cylinder head.

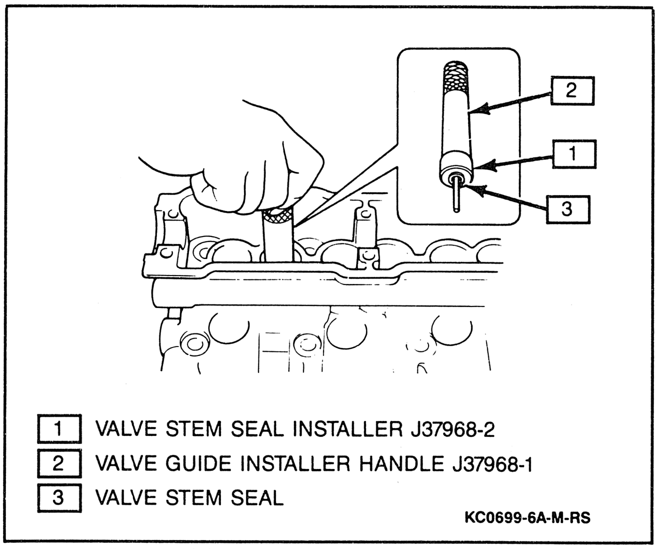

2
1
3
1 VALVE STEM SEAL INSTALLER J37968-2
2 VALVE GUIDE INSTALLER HANDLE J37968-1
3 VALVE STEM SEAL
KC0699-6A-M-RS

Figure 99 Installing Valve Stem Seal

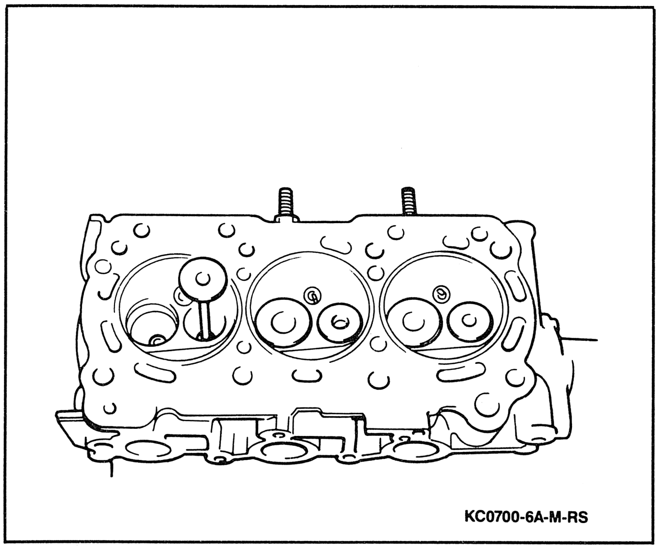

KC0700-6A-M-RS

Figure 100 Installing Valve

Install or Connect

1. Cylinder head gasket. Install new head gasket as shown (Figure 103) with the "TOP" mark provided on the gasket on top side (toward cylinder head) and on crankshaft pulley side.
2. Cylinder head: After applying engine oil to cylinder head bolts, tighten them gradually with a torque wrench, following sequence given in (Figure 104).

   Tighten

   - Bolts to 73 N·m (54 lb.ft.).
     Bolts
3. Rubber seal between water pump and cylinder head.
4. Cylinder head cover.
5. Timing belt as previously outlined.
6. Distributor to cylinder head. Refer to IGNITION SYSTEM (Section 6D4).
7. Reverse removal procedure for installation of remainder.

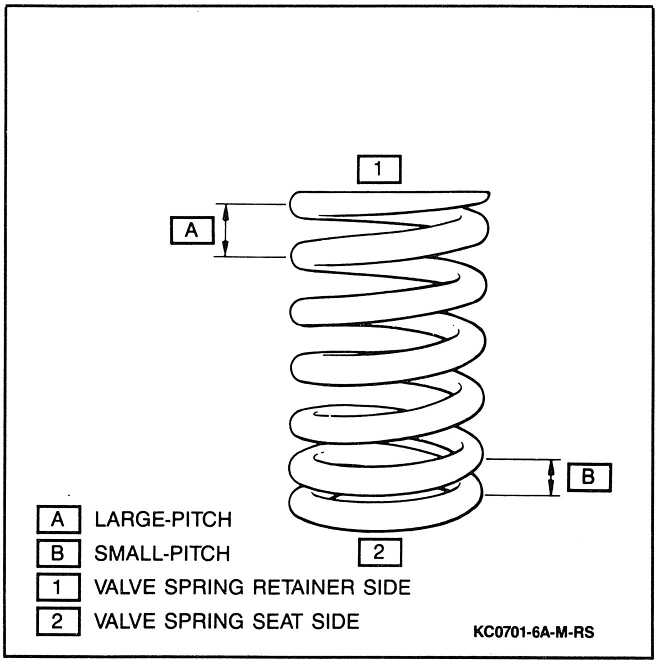

1
A
B
2
A LARGE-PITCH
B SMALL-PITCH
1 VALVE SPRING RETAINER SIDE
2 VALVE SPRING SEAT SIDE
KC0701-6A-M-RS

Figure 101 Installing Valve Spring

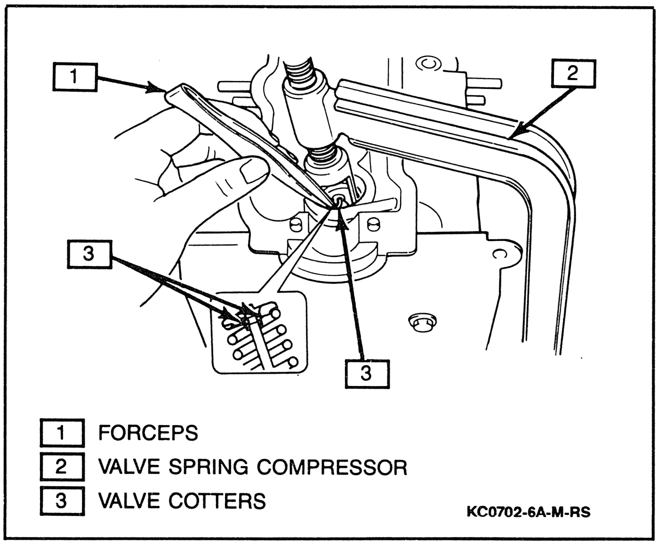

1
2
3
3
1 FORCEPS
2 VALVE SPRING COMPRESSOR
3 VALVE COTTERS
KC0702-6A-M-RS

Figure 102 Installing Valve Cotters

8. Adjust water pump belt. Refer to ENGINE COOLING (Section 6B) for adjusting procedure.
9. Adjust accelerator cable play according to procedure described in section 6E.
10. Refill cooling system, refer to ENGINE COOLING (Section 6B).
11. Negative battery cable.
12. Adjust ignition timing. Refer to DRIVEABILITY AND EMISSIONS (Section 6E) for adjustment.
13. Upon completion of installation, verify that there is no fuel leakage, water leakage, or exhaust gas leakage at each connection.

PISTONS, PISTON RINGS, CONNECTING RODS AND CYLINDERS

Remove or Disconnect

1. Cylinder head from cylinder block as previously outlined.

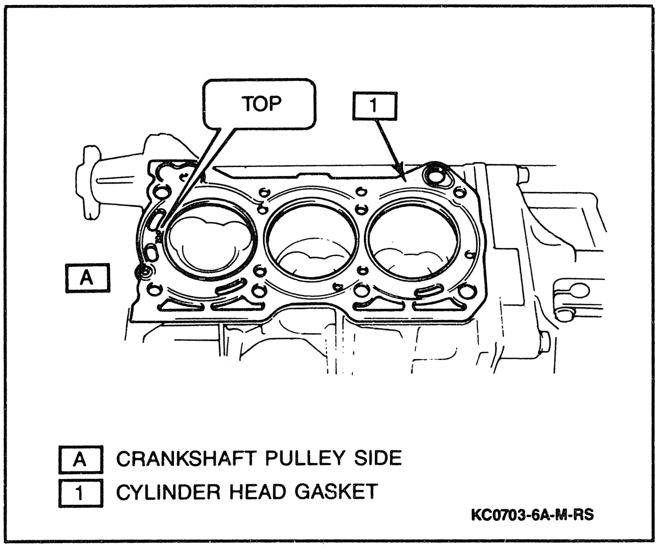

TOP
1
A
A CRANKSHAFT PULLEY SIDE
1 CYLINDER HEAD GASKET
KC0703-6A-M-RS

Figure 103 Installing Cylinder Head Gasket

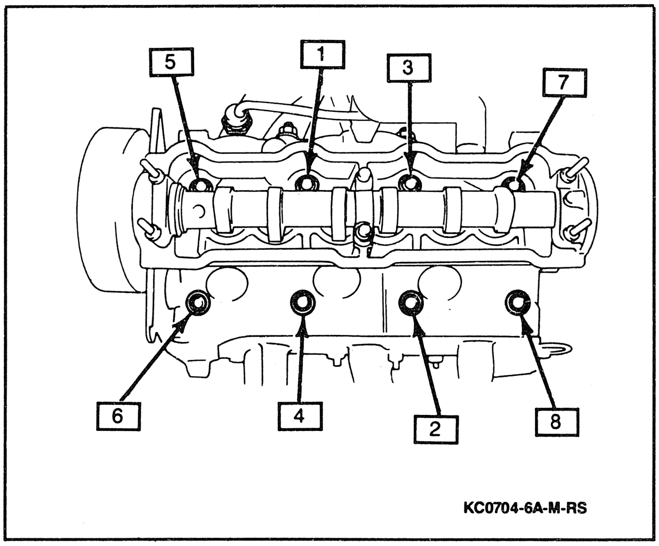

5
1
3
7
6
4
2
8
KC0704-6A-M-RS

Figure 104 Tightening Sequence of Cylinder Head

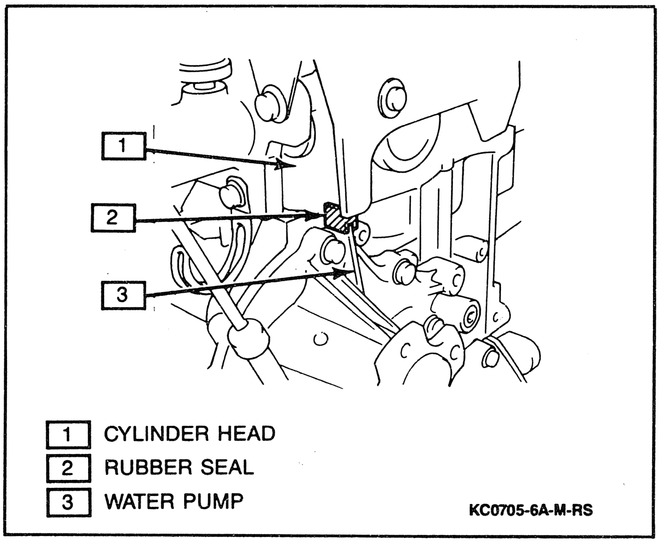

1
2
3
1 CYLINDER HEAD
2 RUBBER SEAL
3 WATER PUMP
KC0705-6A-M-RS

Figure 105 Installing Rubber Seal

2. Drain engine oil.
3. Oil pan and oil pump strainer.
4. Mark the cylinder number on all pistons, connecting rods and rod bearing caps.
5. Rod bearing caps.
6. Install a piece of hose over threads of rod bolts. This is to prevent damage to bearing journal and rod bolt threads when removing the connecting rod.
7. Decarbon the top of the cylinder bore, before removing the piston from the cylinder.

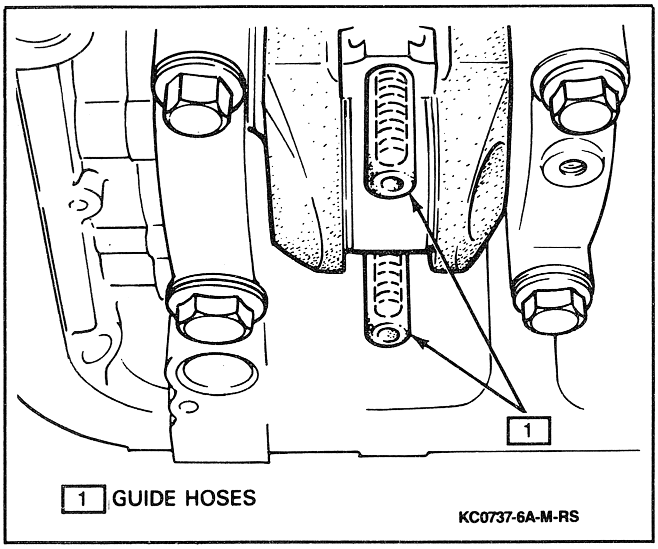

1
1 GUIDE HOSES
KC0737-6A-M-RS

Figure 106 Guide Hoses Installation

8. Push piston and connecting rod assembly out through the top of the cylinder bore.

Disassemble

1. Using piston ring expander, remove two compression rings (Top and 2nd) and oil ring from piston.
2. Piston pin from connecting rod. Fit piston and connecting rod assembly to tool J24086-10 (Piston pin remover and installer) so that the arrow mark on piston head faces up (Figure 107).

Clean

- Carbon from piston head and ring grooves, using a suitable tool.

Cylinders

Inspect

- Cylinder walls for scratches, roughness, or ridges which indicate excessive wear. If cylinder bore is very rough or deeply scratched, or ridged, rebore the cylinder and use oversized piston.
- Using a cylinder gage, measure the cylinder bore in thrust and axial direction at two positions (Figure 108). If any of the following measurements are out of specifications, rebore the cylinder.
  1. Cylinder bore diameter exceeds the limit.

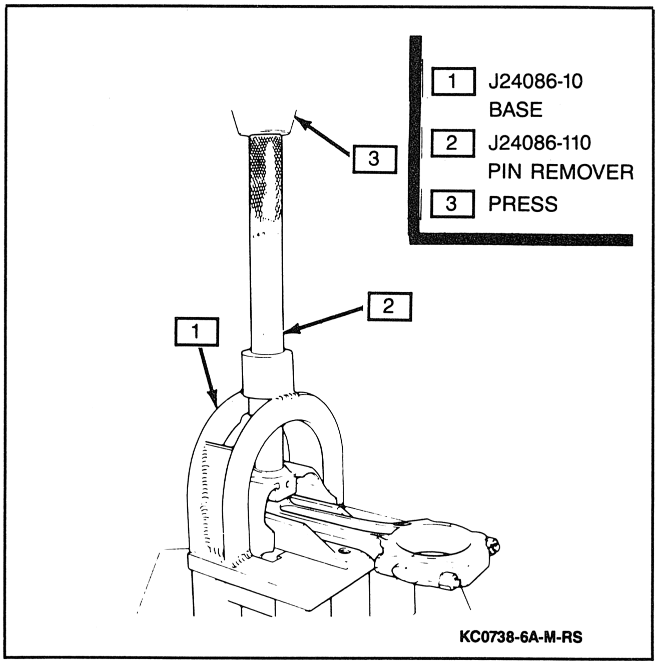


Figure 107 Piston Pin Removal

2. Difference of measurements at two positions exceeds the taper limit.
3. Difference between thrust and axial measurements exceeds the out-of-round limit.

NOTICE: If any one of the three cylinders has to be rebored, rebore the three to the same next oversize. This is necessary for the sake of uniformity and balance.

Pistons

Inspect

- Piston for cracks or other damage. Damaged pistons should be replaced.
- Piston diameter: Piston diameter should be measured at the height of 11.5 mm (0.45 in.) from the piston skirt end in the direction perpendicular to piston pin (Figure 110).
- Piston clearance:

To calculate piston clearance, measure cylinder bore diameter and piston diameter. This piston clearance is the difference between cylinder bore diameter and piston diameter. This piston clearance should be within the specification stated below.

If it is out of specification, rebore the cylinder and use oversize piston. Piston clearance 0.02 -0.04 mm (0. 0008 - 0.0015 in.). The cylinder bore diameters measured in thrust direction at two positions (Figure 108) should be used calculation of piston clearance.

- Ring groove clearance:

Before checking, the piston grooves must be clean, dry and free of carbon.

Fit the new piston ring into groove and measure the clearance between the ring and the ring land by using thickness gage.

Cylinder Bore Dia. Limit	74.15 mm 2.9193 in
Taper and Out-of-Round Limit	0.10 mm 0.0039 in

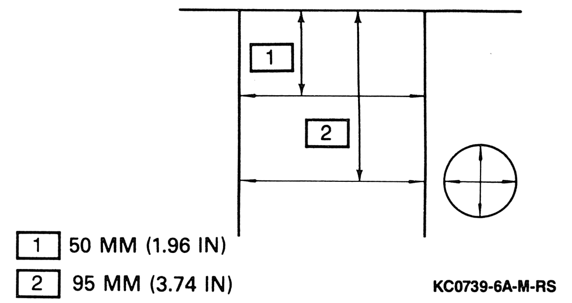


Figure 108 Positions to be Measured

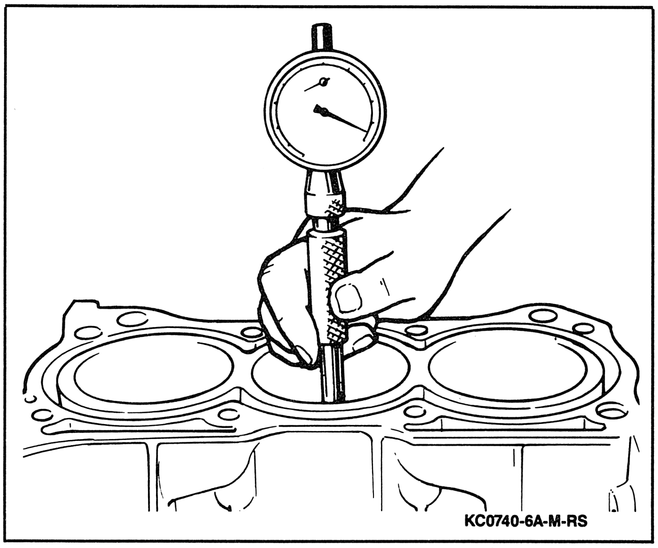


Figure 109 Measuring Cylinder Bore with Cylinder Gage

If the clearance is out of specification, replace the piston (Figure 111).

Piston Pin

- Piston pin must be fitted into the piston bore with an easy finger push at normal room temperature.
- Check piston pin or piston bore is badly worn or damaged, replace pin or piston, or both.

Piston Rings

To measure the end gap, insert the piston ring into the top of cylinder bore and then measure the gap by using the thickness gage.

If the gap measured is out of specification, replace the ring. Decarbon and clean the top of cylinder bore, before inserting the piston ring (Figure 112).

Connecting Rod

- Side clearance:

Check connection rod for side clearance with the rod fitted and connected to its crank pin. If the

Piston Diameter	Standard	73.970 — 73.990 mm 2.9122 — 2.9129 in
	Oversize: 0.25 mm (0.0098 in.)	74.220 — 74.230 mm 2.9220 — 2.9224 in
	0.50 mm (0.0196 in.)	74.47 — 74.48 mm 2.9319 — 2.9322 in

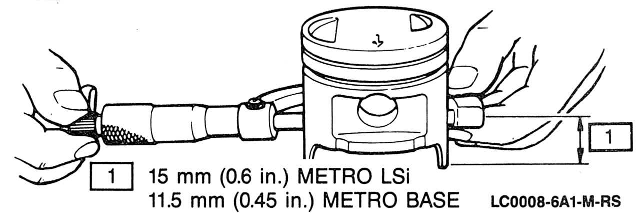


Figure 110 Mearsuring Piston Diameter with Micrometer

Ring Groove Clearance	Top	0.03 — 0.07 mm 0.0012 — 0.0027 in
	2nd	0.02 — 0.06 mm 0.0008 — 0.0023 in

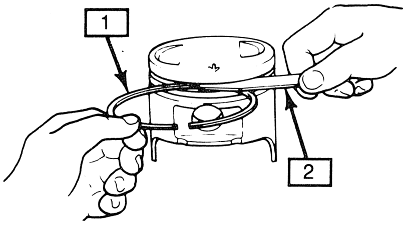


Figure 111 Measuring Ring Groove Clearance

ITEM		STANDARD	LIMIT
PISTON RING END GAP	TOP RING	0.20-0.30 mm 0.0079-0.129 in.	0.7 mm 0.0275 in.
	2ND RING	0.20-0.30 mm 0.0079-0.0137 in.	0.7 mm 0.0275 in.
	OIL RING	0.20-0.60 mm 0.0079-0.0275 in.	1.8 mm 0.0708 in.

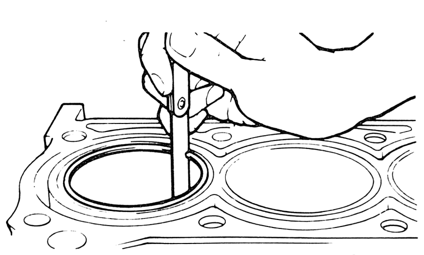


Figure 112 Measuring Piston Ring End Gap

clearance measured is found to exceed the limit, replace the connecting rod (Figure 113).

Item	Standard	Limit
Big-End Side Clearance	0.10 — 0.20 mm (0.0039 — 0.0078 in)	0.35 mm (0.0137 in)

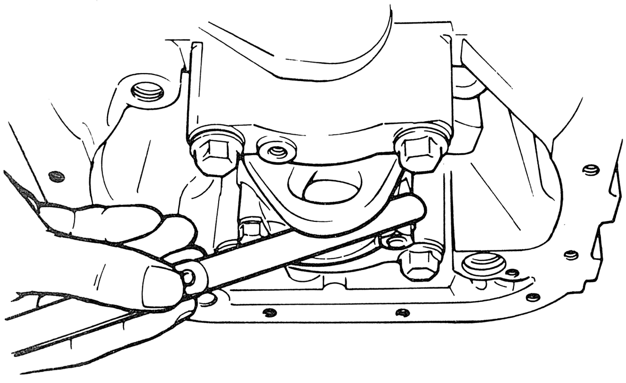


Figure 113 Measuring Side Clearance

Connecting Rod Alignment

Mount connecting rod on aligner to check for bow and/or twist. If the limit on bow exceeds 0.005 mm (0.00020 in.) or if the limit on twist exceeds 0.10 mm (0.0039 in.), replace connecting rod.

Crank Pin and Connecting Rod Bearings

- Inspect the crank pin for uneven wear or damage. Measure the crank pin for out-of-round or taper with a micrometer. If crank pin is damaged, or out-of-round or taper is out of limit, replace the crankshaft or regrind the crank pin to undersize and use undersize bearing (Figure 114).

Connecting Rod Bearing Size	Crank Pin Diameter
Standard	41.982 — 42.000 mm 1.6529 — 1.6535 in
0.25 mm (0.0098 in) Undersize	41.732 — 41.750 mm 1.6430 — 1.6437 in
Out-of-Round and Taper Limit	0.01 mm 0.0004 in

KC0745-6A-M-RS

Figure 114 Crankshaft Bearings

- Rod Bearings:

Inspect the bearing shells for signs of pitting, burn or flaking and observe the contact pattern. Bearing shells found to be defective must be replaced.

Two kinds of rod bearing are available: standard size bearing and 0.25 mm undersize bearing. To distinguish them, 0.25 mm undersize bearing has the stamped number (US 025) on its backside as indicated in (Figure 115), but standard size has no number.

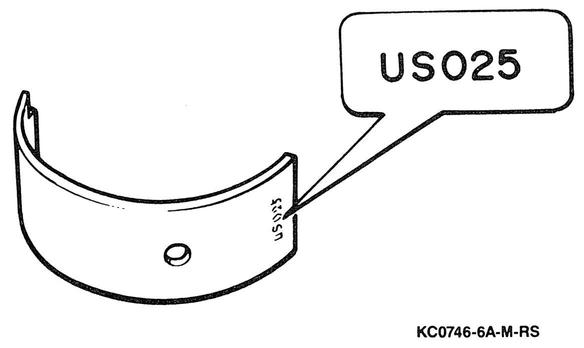


Figure 115 0.025 mm Undersize Bearing

Rod Bearing Clearance

1. Before checking bearing clearance, clean the bearing and the crank pin.
2. Install the bearing in the connecting rod and the bearing cap.
3. Place a piece of gaging plastic the full width of the crankpin as contacted by bearing (parallel to the crankshaft), avoiding the oil hole.
4. Install the rod bearing cap to connecting rod. When installing the cap, be sure to point the arrow mark on the cap to crankshaft pulley side, as indicatd in (Figure 116). DO NOT turn the crankshaft with gaging plastic installed.

Tighten

- Bearing cap nuts to 35 N·m (26 lb.ft.).

5. Remove the cap and using the scale on the gaging plastic envelope, measure the gaging plastic width at the widest point. If the clearance exceeds the limit, use a new standard size bearing and remeasure the clearance (Figure 117).
6. If the clearance can not be brought to within the limit even by using a new standard size bearing, regrind the crankpin to the undersize and use the 0.25 mm oversize bearing.

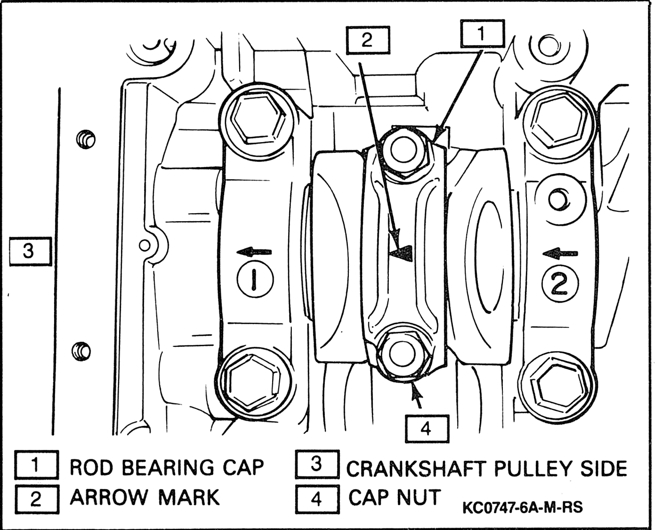


Figure 116 Installing Bearing Cap

	Standard	Limit
Bearing Clearance	0.030 — 0.050 mm 0.0012 — 0.0019 in	0.080 mm 0.0031 in

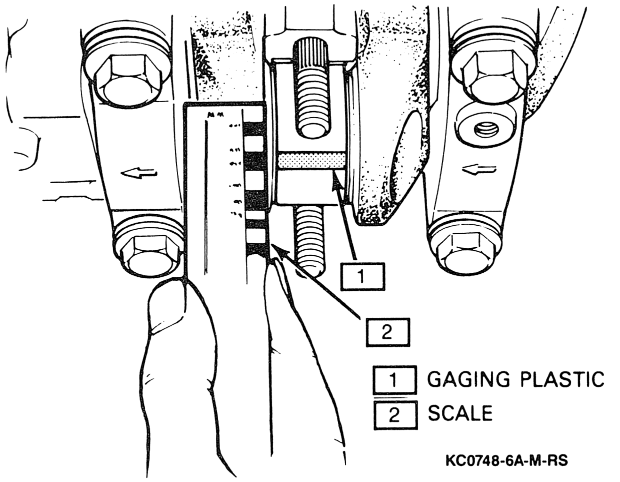


Figure 117 Measuring Rod Bearing Clearance

Assemble

NOTICE: Two sizes of piston are available as standard size spare parts so as to ensure proper piston-to-cylinder clearance. When installing a standard size piston, make sure to match the piston with the cylinder as follows.

- Each piston has a stamped number 1 or 2. It indicates the outer diameter of the piston (Figure 118).
- There are also stamped numbers of 1 and 2 on the cylinder block. The first number indicates inner diameter of the No.1 cylinder, the second number of the No.2 cylinder and the third number of the No. 3 cylinder (Figure 119).

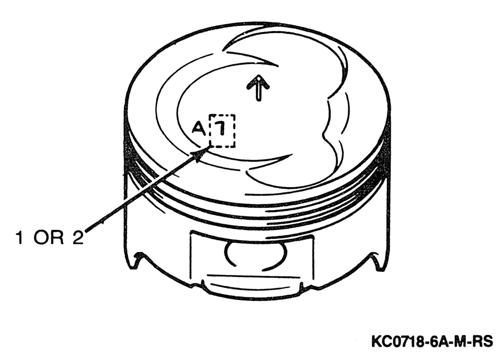


Figure 118 Piston Identification

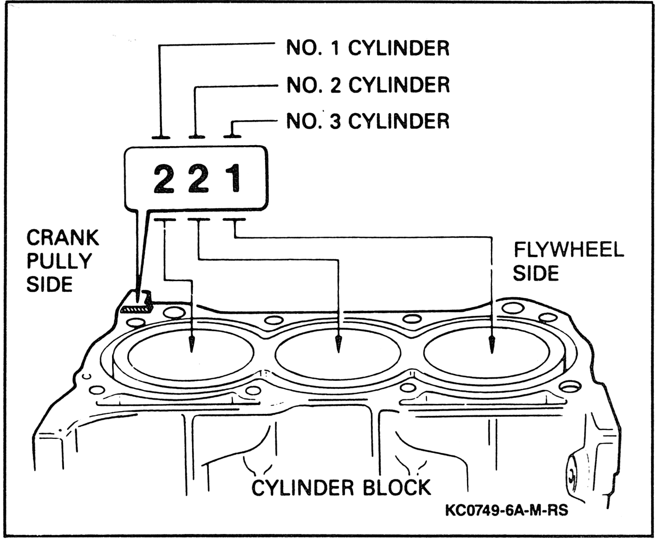

NO. 1 CYLINDER
NO. 2 CYLINDER
NO. 3 CYLINDER
2 2 1
CRANK PULLY SIDE
FLYWHEEL SIDE
CYLINDER BLOCK
KC0749-6A-M-RS

Figure 119 Cylinder Identification

- Use a number 2 stamped piston for installation if the cylinder identified with number 2 and a number 1 piston for the cylinder with number 1. Also, a letter A, B, or C is stamped on the piston head but ordinarily it is not necessary to discriminate each piston by this number.

1. Connecting rod to piston:

After applying engine oil to piston pin holes in piston and connecting rod, fit connecting rod to piston (Figure 122).

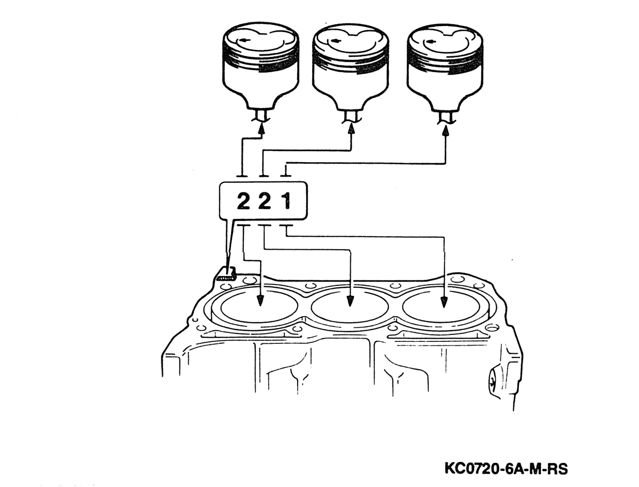

2 2 1
KC0720-6A-M-RS

Figure 120 Piston to Cylinder Orientation

2. Piston pin to piston and connecting rod:

Place the piston on tool J24086 (Piston pin remover and installer) in such a way that the arrow mark on piston head faces up (Figure 123).

Important

- Before installing pin to piston, set installer J24086-9 to E4 for proper pin setting.

3. Piston rings to piston:

Piston		Cylinder		Piston-to-Cylinder Clearance
Number At The Top (Mark)	Outside Diameter	Number (Mark)	Bore Diameter	
1	73.98 — 73.99 mm (2.9126 — 2.9130 in)	1	74.01 — 74.02 mm (2.9138 — 2.9142 in)	0.02 — 0.04 mm (0.0008 — 0.0015 in)
2	73.97 — 73.98 mm (2.9122 — 2.9126 in)	2	74.00 — 74.01 mm (2.9134 — 2.9138 in)	0.02 — 0.04 mm (0.0008 — 0.0015 in)

KC0750-6A-M-RS

Figure 121 Piston and Cylinder Specification

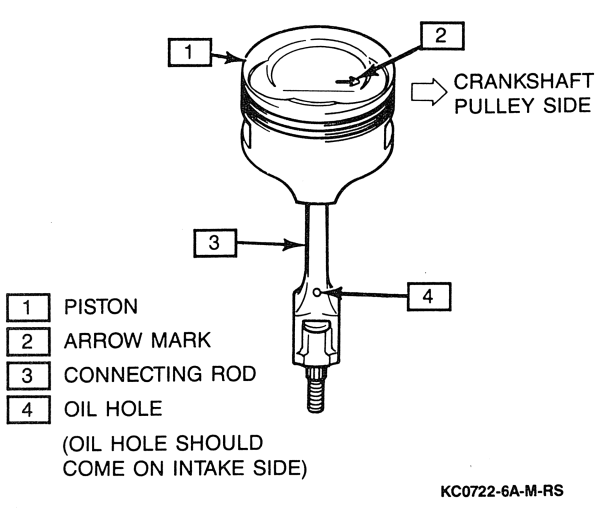

1
2
CRANKSHAFT PULLEY SIDE
3
4
1 PISTON
2 ARROW MARK
3 CONNECTING ROD
4 OIL HOLE
(OIL HOLE SHOULD COME ON INTAKE SIDE)
KC0722-6A-M-RS

Figure 122 Fitting Connecting Rod to Piston (R and S Engines)

- As shown (Figure 124) 1st and 2nd rings have "R" or "T" mark. When installing these piston rings to piston, face the marked side of each ring to the top of piston.

NOTICE: There are two types of 1st ring, marked and unmarked. When installing a new unmarked 1st ring it is not necessary to distinguish it's top from bottom (i.e., either side can face upward but when reinstalling a used one be sure to distinguish its top from bottom as it was installed before removal and direct topside upward).

- 1st ring differs from 2nd ring in thickness, shape and color of the surface contacting cylinder wall (Figure 124).
- When installing oil ring, install the spacer first and then two rails.

4. After installing the three rings (1st, 2nd and oil rings), align their end gaps (Figure 125).

Install or Connect

1. Apply engine oil to pistons, rings, cylinder walls, connecting rod bearings, and crankpins.
2. Install a piece of hose over connecting rod threads. These guide hoses protect the crankpin

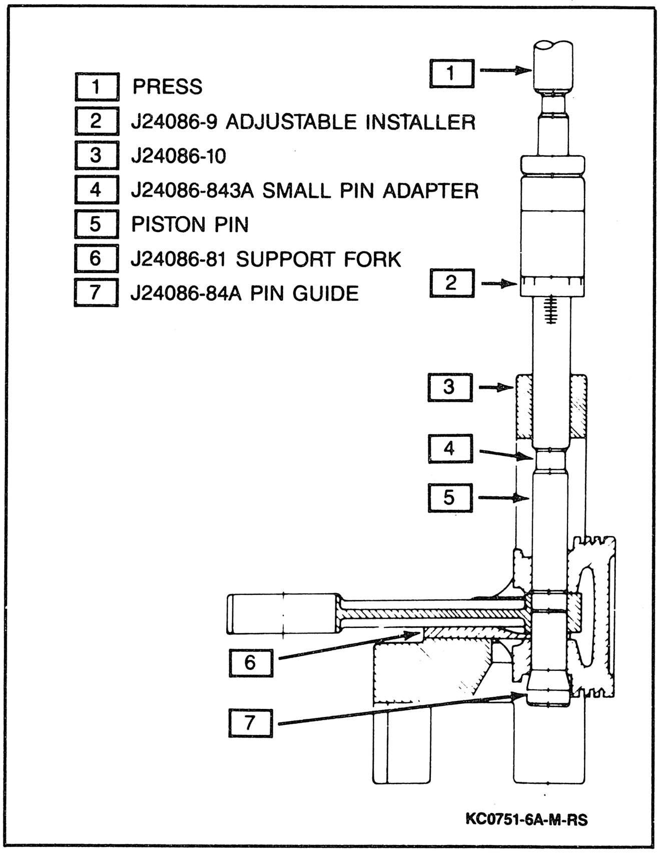

1 PRESS
2 J24086-9 ADJUSTABLE INSTALLER
3 J24086-10
4 J24086-843A SMALL PIN ADAPTER
5 PISTON PIN
6 J24086-81 SUPPORT FORK
7 J24086-84A PIN GUIDE
1
2
3
4
5
6
7
KC0751-6A-M-RS

Figure 123 Installing Piston Pin

and threads of rod bolt from damage during installation of connecting rod and piston assembly.

3. When installing piston and connecting rod assembly into cylinder bore, point the arrow mark on piston head to crankshaft pulley side.
4. Piston and connecting rod assembly into cylinder bore. Use J8037 (Piston ring compressor) to compress the rings. Guide the connecting rod into place on the crankshaft. Using a hammer handle, tap the piston head to install the piston into the bore, hold the ring compressor firmly against the cylinder block until all piston rings have entered the cylinder bore.
5. Bearing Cap: When installing the cap to the rod, point the arrow mark on cap to crankshaft pulley side.

Tighten

- Bearing cap nuts to 35 N·m (26 lb.ft.).

6. Reverse the removal procedures for the installation of remaining parts.
7. Adjust the water pump belt tension.
8. Refill engine oil.
9. Refill cooling system.
   Head
10. Negative battery cable.
11. Adjust accelerator cable. See DRIVEABILITY AND EMISSIONS (Section 6E).
12. Check ignition timing and adjust as necessary.
13. Upon completion of installation, verify that there is no fuel, water, or exhaust gas leaks.

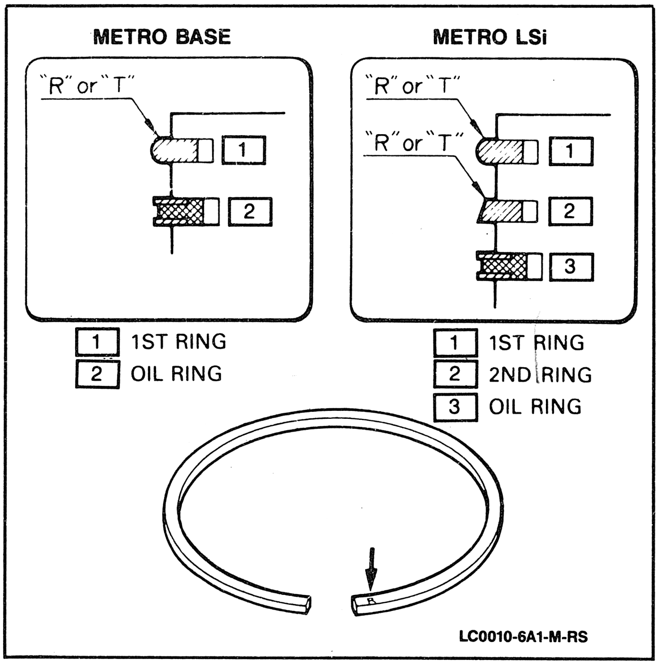

METRO BASE
METRO LSi
"R" or "T"
"R" or "T"
"R" or "T"
1
2
1
2
3
1 1ST RING
2 OIL RING
1 1ST RING
2 2ND RING
3 OIL RING
LC0010-6A1-M-RS

Figure 124 Piston Rings Installation

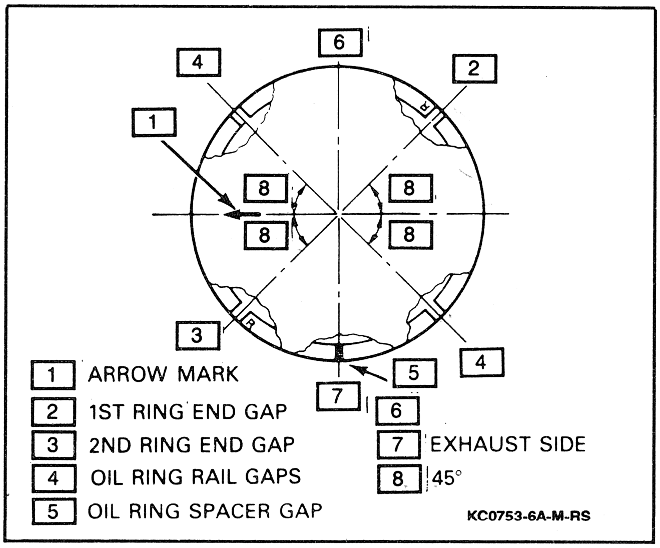

1
2
3
4
4
5
6
6
7
8
8
8
8
1 ARROW MARK
2 1ST RING END GAP
3 2ND RING END GAP
4 OIL RING RAIL GAPS
5 OIL RING SPACER GAP
6
7 EXHAUST SIDE
8 45°
KC0753-6A-M-RS

Figure 125 Piston Ring End Gaps Positions

MAIN BEARINGS

With Crankshaft Installed

Remove or Disconnect

1. Oil pan as previously outlined.
2. Generator belt.
3. Air conditioning belt as previously outlined.
4. Plug in right hand inner fender. In order to gain access to turn crankshaft with ratchet.
5. Remove main bearing cap.
6. Remove main bearing.

General Information

- Service main bearings are available in standard size and 0.25 mm (0.0098 in.) undersize, and each of them have 5 kinds of bearings difffering in tolerance.

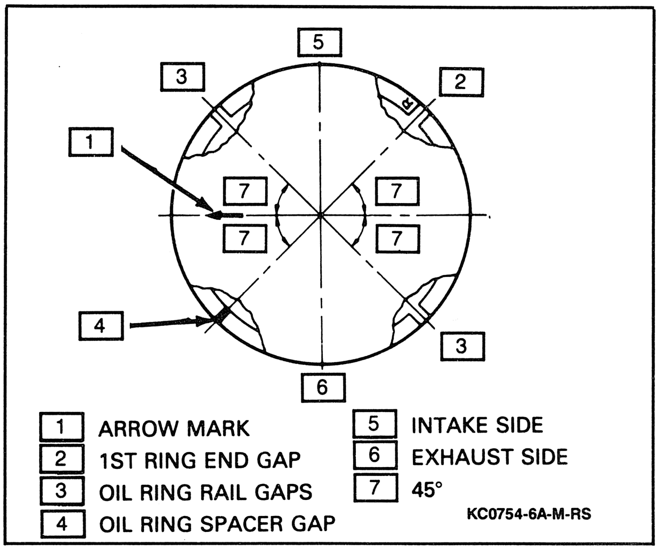

5
3
2
1
7
7
7
7
4
3
6
1 ARROW MARK
2 1ST RING END GAP
3 OIL RING RAIL GAPS
4 OIL RING SPACER GAP
5 INTAKE SIDE
6 EXHAUST SIDE
7 45°
KC0754-6A-M-RS

Figure 126 Engine Piston Ring Gaps

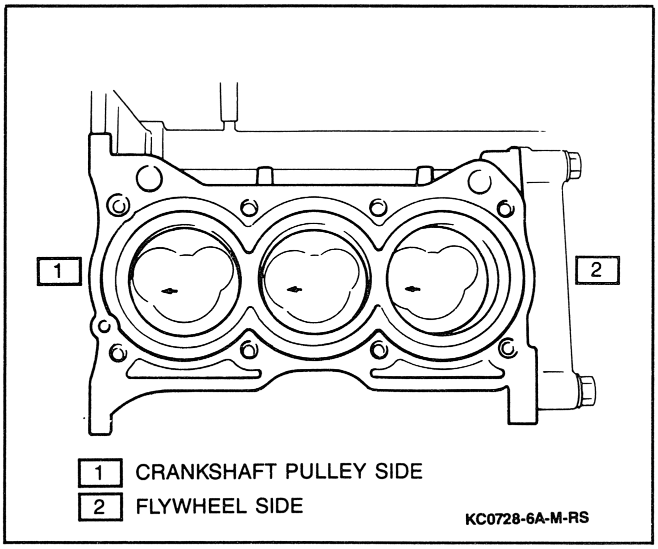

1
2
1 CRANKSHAFT PULLEY SIDE
2 FLYWHEEL SIDE
KC0728-6A-M-RS

Figure 127 Direction of Arrow Mark on Piston

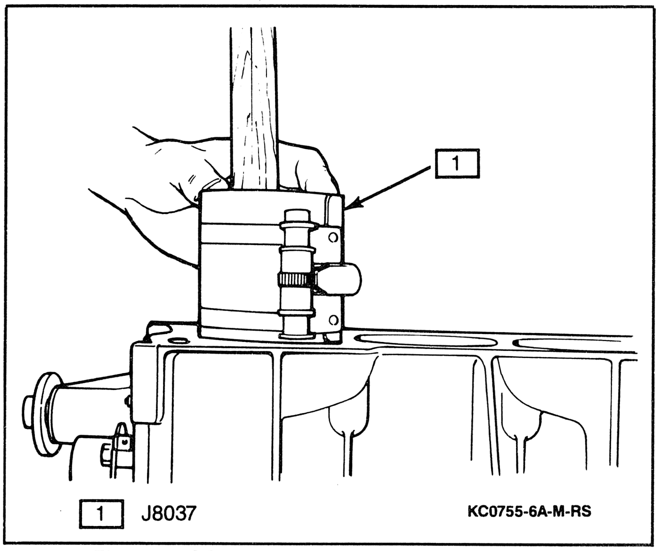

1
1 J8037
KC0755-6A-M-RS

Figure 128 Installing Piston to Cylinder

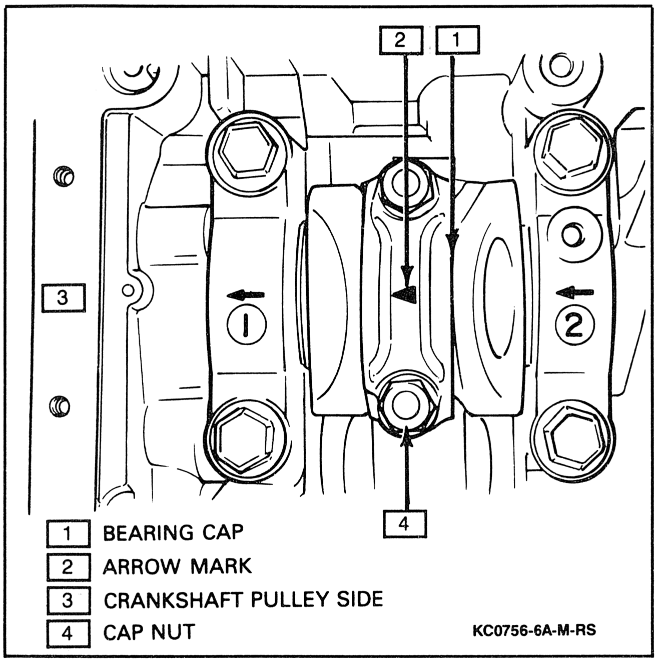

2
1
3
4
1 BEARING CAP
2 ARROW MARK
3 CRANKSHAFT PULLEY SIDE
4 CAP NUT
KC0756-6A-M-RS

Figure 129 Installing Bearing Cap

- The upper half of bearing has an oil groove. Install this half with oil groove to cylinder (Figure 130).
- On each main bearing cap, the arrow mark and number are embossed (Figure 131). When installing each bearing cap to cylinder block, point the arrow mark toward crankshaft pulley side and install each cap from crankshaft pulley side to flywheel side in order "1", "2", "3", and "4".

Tighten

- Cap bolts to 54 N·m (40 lb.ft.).

Inspect

Check the bearings for pitting, scratches, wear, or damage.

If any of the above is found, replace both upper and lower halves. Never replace one half without replacing the other half.

Main Bearing Clearance

Check the clearance by using gaging plastic. The procedure is as follows:

1. Remove bearing caps.
2. Clean the bearings and main journals.
3. Place a piece of gaging plastic the full width of bearing (parallel to the crankshaft) on the journal, avoiding oil hole.
4.. Install the bearing cap as previously outlined and torque the cap bolts to the specified torque. Bearing cap MUST be torqued to specification in order to assure proper reading.

NOTICE: Do not rotate crankshaft while gaging plastic is installed.

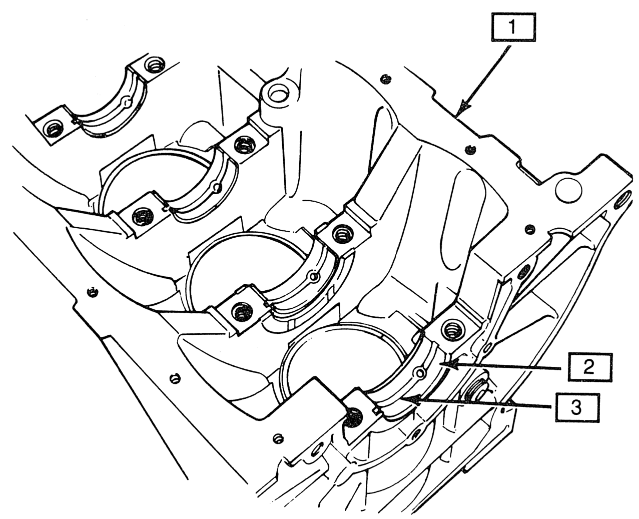


Figure 130 Upper Half of Bearing Installation

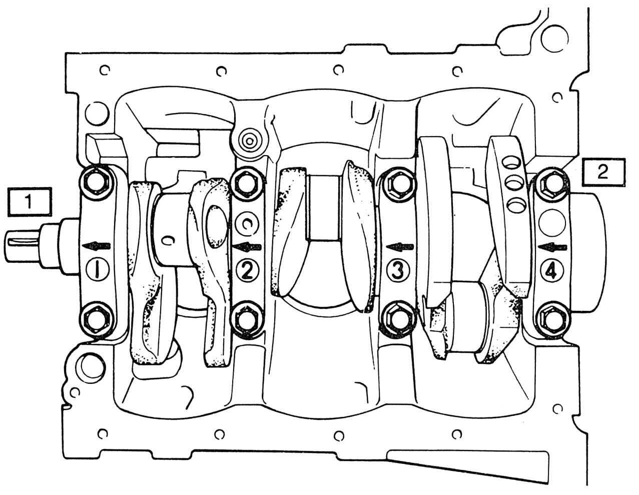


Figure 131 Bearing Caps Installation

5. Remove the cap, and using the scale on the gaging plastic envelope, measure the gaging plastic width at its widest point. If the clearance exceeds the limit, replace the bearing. Always replace both upper and lower inserts as a unit. A new standard bearing may produce proper clearance. If not, it will be necessary to regrind undersize bearing. After selecting new bearing, recheck the clearance (Figure 132).

	Standard	Limit
Bearing Clearance	0.020 — 0.040 mm 0.00008 — 0.0015 in	0.060 mm 0.0023 in

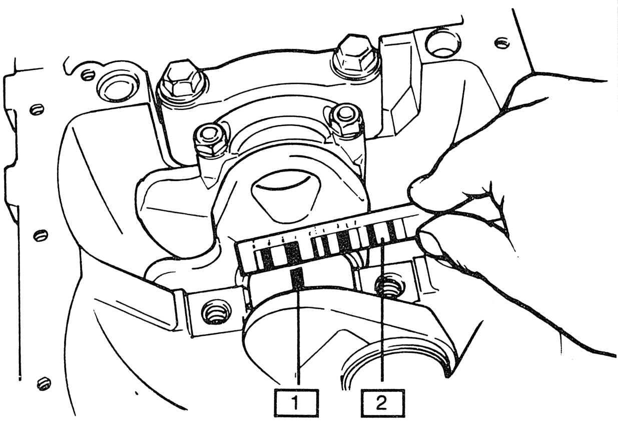


Figure 132 Measuring Main Bearing Clearance

SELECTION OF MAIN BEARINGS

STANDARD BEARING

If the bearing is damaged, or the bearing clearance is out of specification, select a new standard bearing according to the following procedure and install it.

1. Check the journal diameter by the method below.

The counter weights of No.1 cylinder have four stamped numbers. The three numbers can be a ("1", "2", and "3"). The first, second, third and fourth (left to right) stamped numbers indicate the journal diameters at bearing cap "1", "2", "3", and "4" respectively. For example, the first (leftmost) number "3" indicates that the journal diameter at bearing cap "1" is with 44.982 - 44.988 mm, and the second one "1" indicates that the journal diameter at cap "2" is within 44.994 - 45.000 mm (Figure 131).

2. Check the bearing cap bore diameter without bearing. On the mating surface of cylinder block, four letters are stamped. The stamped letters indicate the following cap bore diameters. The first, second, third, and fourth (left to right) stamped letters indicate the cap bore diameters of bearing caps "1", "2", "3", and "4", respectively. The first (leftmost) letter "B" indicates that the cap bore diameter of bearing cap "1" is within 49.006 - 49.012 mm, and the fourth (rightmost) letter "A" indicates that the cap bore diameter cap "4" is within 49.000 - 49.006 mm (Figure 134).

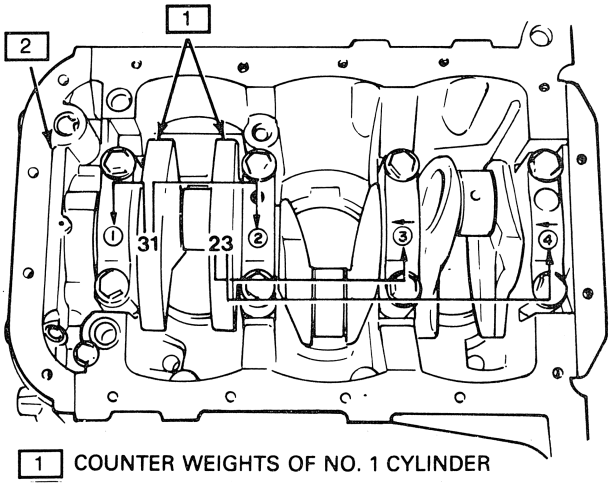
3. There are five sizes of standard bearings. To distinguish them, they are painted the following colors at the position (Figure 135). Each color indicates the following thicknesses at the center of bearing.

4. From the numbers stamped on the counter weights of No. 1 cylinder and the letters stamped on the mating surface of cylinder block, determine new standard bearing to be installed on the journal, by referring to the table (Figure 134). For example if the number stamped on the counter weight is "1" and letter stamped on the mating surface is "B", install the new standard bearing painted with "Black" to its journal.

5. Using gaging plastic, check the bearing clearance with the new standard bearing selected. If the clearance still exceeds the limit, use the next thicker bearing and recheck the clearance.

6. When replacing the crankshaft or the engine block due to any reason, select new standard bearings to be installed by referring to the numbers stamped on new crankshaft or the letters stamped on the mating surface of new engine block.

Numeral Stamped	Journal Diameter
1	44.994 — 45.000 mm 1.7714 — 1.7716 in
2	44.988 — 44.994 mm 1.7712 — 1.7714 in
3	44.982 — 44.988 mm 1.7710 — 1.7712 in



1 COUNTER WEIGHTS OF NO. 1 CYLINDER

2 OIL PUMP

KC0760-6A-M-RS

Figure 133 Stamped Number on Crankwebs of No. 1 Cylinder

UNDERSIZE BEARING (0.25 MM)

0.25 mm undersize bearing is available.

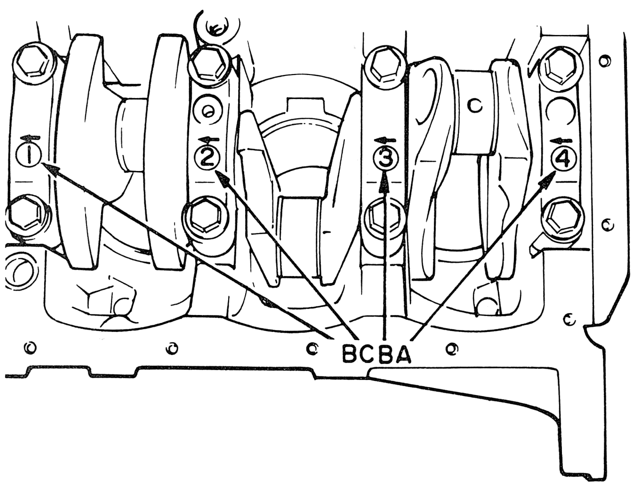
To distinguish them, each bearing is painted the following colors at the position (Figure 137).

Each color indicated the following thicknesses at the center of the bearing.

If the crankshaft journal has to be reground to undersize, regrind the journal and select the undersize bearing to used as follows.

1. Regrind the journal to the following finished diameter 44.732 - 44.750 mm (1.7612 - 1.7618).

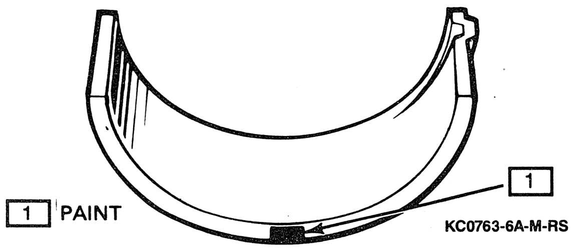
	Bearing Cap Bore Diameter (Without Bearing)
A	49.000 — 49.006 mm 1.9292 — 1.9294 in
B	49.006 — 49.012 mm 1.9294 — 1.9296 in
C	49.012 — 49.018 mm 1.9296 — 1.9298 in



KC0762-6A-M-RS

Figure 134 Stamped Letters on Cylinder Block

Color Painted	Bearing Thickness
Green	1.996 — 2.000 mm 0.0786 — 0.0787 in
Black	1.999 — 2.003 mm 0.0787 — 0.0788 in
Colorless (No Paint)	2.002 — 2.006 mm 0.0788 — 0.0789 in
Yellow	2.005 — 2.009 mm 0.0789 — 0.0790 in
Blue	2.008 — 2.012 mm 0.0790 — 0.0791 in



1 PAINT

KC0763-6A-M-RS

Figure 135 Paint on Standard Bearing

2. Using a micrometer, measure the reground journal diameter. The measurement should be taken in two directions perpendicular to each other in order to check for out-of-round.
3. From the journal diameter measured above and the letters stamped on mating surface of cylinder block, select the oversize bearing to be installed by referring to the table (Figure 137).

		Numerals Stamped on Crank Webs (Journal Diameter)		
		1	2	3
Letters Stamped on Mating Surface	A	Green	Black	Colorless
	B	Black	Colorless	Yellow
	C	Colorless	Yellow	Blue
		New Standard Bearing To Be Installed.		

KC0764-6A-M-RS

Figure 136 Bearing Identification

Color Painted	Bearing Thickness
Green & Red	2.121 — 2.125 mm 0.0835 — 0.0836 in
Black & Red	2.124 — 2.128 mm 0.0836 — 0.0837 in
Red Only	2.127 — 2.131 mm 0.0837 — 0.0838 in
Yellow & Red	2.130 — 2.134 mm 0.0838 — 0.0839 in
Blue & Red	2.133 — 2.137 mm 0.0839 — 0.0840 in

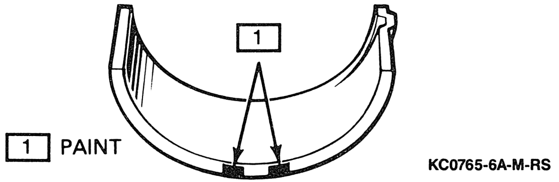


Figure 137 Paints on Oversize Bearing

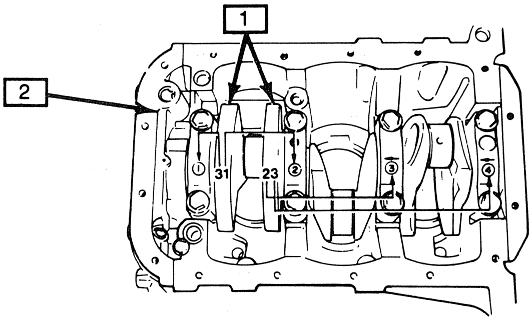
UNIT REPAIR OVERHAUL

ENGINE ASSEMBLY

↔ Remove or Disconnect

1. Relieve fuel pressure according to procedure described in ENGINE FUEL (Section 6C).
2. Engine hood after disconnecting front window washer hose.
3. Negative battery cable.
4. Drain cooling system.
5. Air cleaner assembly.
6. Radiator with cooling fan. Refer to ENGINE COOLING (Section 6B) for removal.
7. Following electric wire harnesses:
   - Spark plug wire from ignition coil.
   - Distributor.
   - Water temperature gage.
   - Radiator fan thermo switch.
   - Vacuum switching valve for EGR valve.
   - Water temperature sensor.
   - Idle speed control solenoid valve.
   - Throttle switch or throttle position switch.
   - Fuel injector.
   - Pressure sensor.
   - Oil pressure gage.
   - Oxygen sensor.
   - Generator.
   - Starter.
   - Backup light switch (for M/T model).
   - Negative battery cable from transaxle.
   - Shift switch (for A/T model).
   - Direct clutch and 2nd brake solenoids (for A/T model).
   - Speed sensor (for A/T model).
8. Following vacuum hoses:
   - Brake booster hose from intake manifold.
   - Canister purge hose from intake manifold.
   - Canister hose from its pipe.
9. Fuel return hose and fuel feed hose from throttle body.
10. Heater inlet and outlet hoses.
11. Following cables:
    - Accelerator cable from throttle body.
    - Clutch cable from transaxle (for M/T model). model).
    - Gear select cable and oil pressure control cable from transaxle (for A/T model).
    - Speedometer cable from transaxle.
12. Hoist vehicle.
13. Exhaust No. 1 pipe from exhaust manifold.
14. Gear shift control shaft and extension rod transaxle for (M/T model).
15. Drain engine oil and transaxle oil.
16. Drive axles (R & L) from differential side gears of transaxle. For engine transaxle removal, it is not necessary to remove drive axle from steering knuckle. For procedure to disconnect drive axle, refer to DRIVE AXLE (Section 4D).
17. Engine rear torque rod bracket from transaxle (for A/T model).
18. Lower vehicle.
19. Install lifting device.
20. Right side engine mounting from its bracket.
21. Transaxle rear mounting from body (for M/T model). Transaxle rear mounting nut (for A/T model). A/T model).
22. Transaxle left side mounting bracket.
23. Engine with transaxle from body.

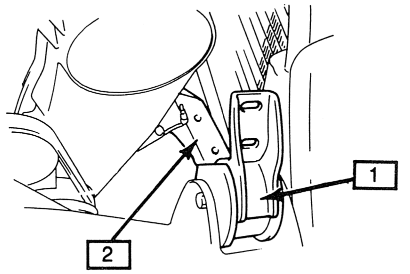
Numeral Stamped	Journal Diameter
1	44.994 — 45.000 mm 1.7714 — 1.7716 in
2	44.988 — 44.994 mm 1.7712 — 1.7714 in
3	44.982 — 44.988 mm 1.7710 — 1.7712 in



1 COUNTER WEIGHTS OF NO. 1 CYLINDER   2 OIL PUMP

KC0760-6A-M-RS

Figure 138 Undersized Bearings



1 RIGHT SIDE ENGINE MOUNTING
2 BRACKET

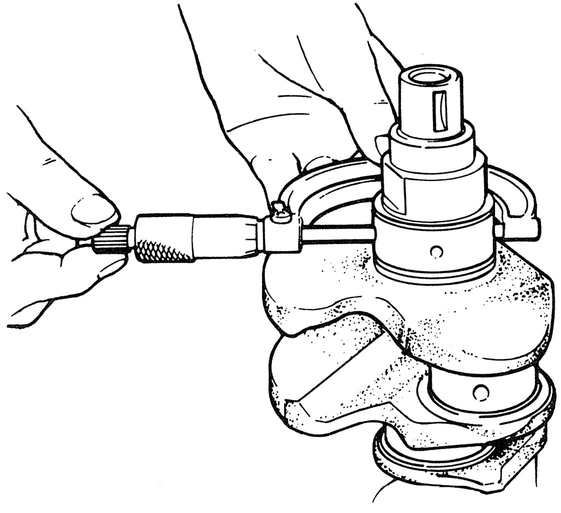
KC0731-6A-M-RS

Figure 139 Right Side Engine Mount Removal

→← Install or Connect

1. Lower engine with transaxle into engine compartment, but do not remove lifting device.
2. Transaxle rear mounting nut (for M/T model). Transaxle rear mounting nut (for A/T model).
3. Transaxle left side mounting bracket.
4. Right side engine mounting to its bracket.
5. Tighten all bolts and nuts of all parts installed in above steps 2, 3, and 4 to specified torque.
6. Remove lifting device.
7. Reverse removal procedures for installation of remainder.
8. Adjust clutch pedal free travel, refer to CLUTCH Section 7C) (for M/T model). Adjust gear select cable and oil pressure control cable, refer to Section 7B (for A/T model).
9. Adjust accelerator cable play.
10. Refill transaxle with gear oil (A/T fluid for A/T model).
11. Refill engine with engine oil, refer to Section 0B.
12. Refill cooling system, refer to Section 6B.
13. Upon completion of installation, verify that there is no fuel leakage, water leakage, or exhaust gas leakage at each connection.

Limit on Out-of-Round and Taper	0.01 mm 0.0004 in



KC0732-6A-M-RS

Figure 140 Engine Mounting (for M/T Model)

CRANKSHAFT

←→ Remove or Disconnect

1. Engine as previously outlined.
2. Alternator belt.
3. Water pump pulley.
4. Crankshaft pulley.
5. Timing belt cover.
6. Timing belt.
7. Distributor cap.
8. Loosen rocker arms.
9. Crankshaft timing gear
10. Alternator adjusting brace and mounting bracket.
11. Oil pan.
12. Oil pump.

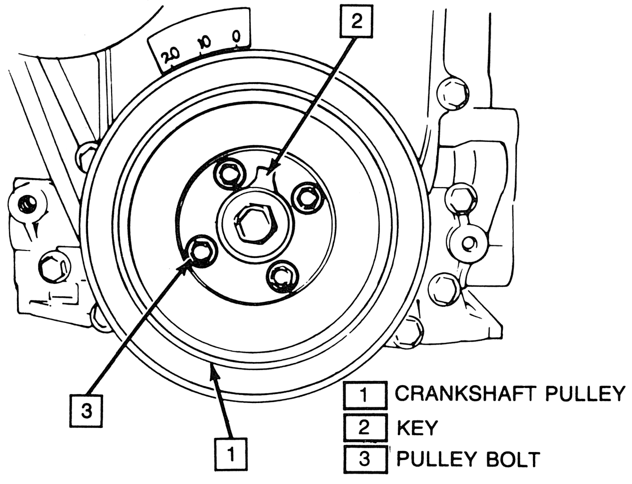


Figure 141 Engine Mounting (for A/T Model)

13. Rear main seal housing.
14. Mark connecting rod caps.
15. Rod caps.
16. Main bearing caps.
17. Crankshaft.
18. Pickup screen.

Inspect

Crankshaft Runout

Using a dial gage, measure the runout at the center journal. Rotate the crankshaft slowly. If the runout exceeds the limit, replace crankshaft.

Crankshaft End Play

Measure end play with crankshaft set in the engine block and with the thrust bearing fitted and journal bearing caps installed.

Tighten

- Bearing cap bolts to 54 N·m (40 lb.ft.).

Use a dial gage to read the displacement in axial (thrust) direction of the crankshaft.

Out-of-Round and Taper (Uneven Wear) of Journals

An unevenly worn crankshaft journal shows up as a difference in diameter at a cross section or along its length (or both). This difference, if any, is to be determined from micrometer readings taken.

Limit on Runout	0.06 mm 0.0023 in

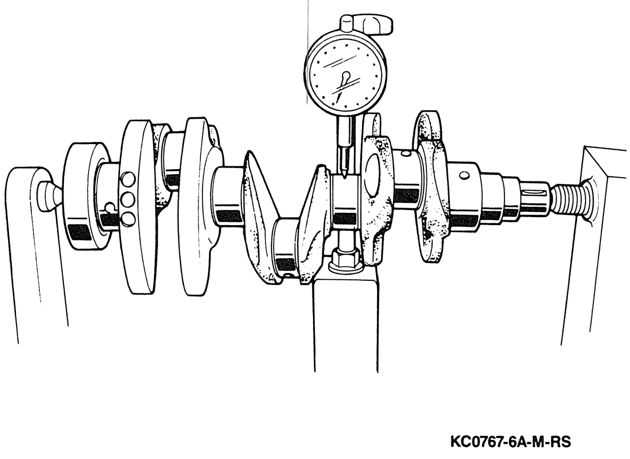


Figure 142 Measuring Runout

Item	Standard		Limit
Crankshaft Thrust Play	0.11 — 0.31 mm 0.0044 — 0.0122 in		0.38 mm 0.0149 in
Thickness of Crankshaft Thrust Bearing	Standard		2.500 mm 0.0984 in.
	0.125 mm 0.0049 in Oversize		2.563 mm 0.1009 in

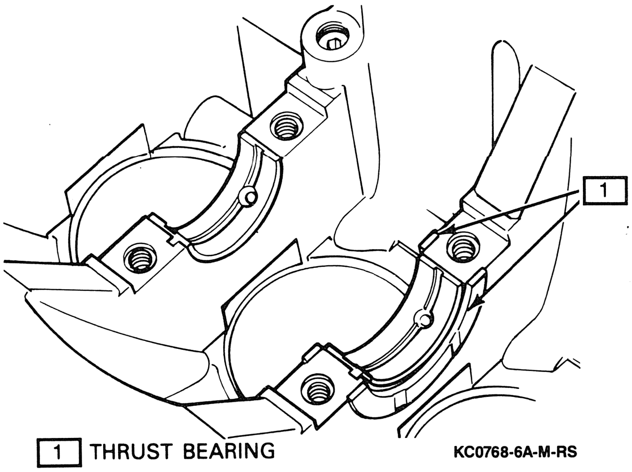


Figure 143 Thrust Bearings

If any of the journals is badly damaged or if the amount exceeds the limit, regrind or replace the crankshaft

FLYWHEEL (M/T ONLY)

Inspect

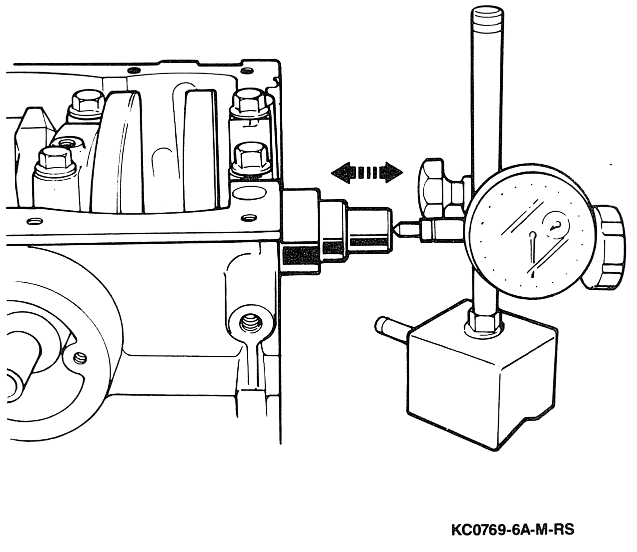


Figure 144 Measuring Thrust Play of Crankshaft

Limit on Out-of-Round and Taper	0.01 mm 0.0004 in

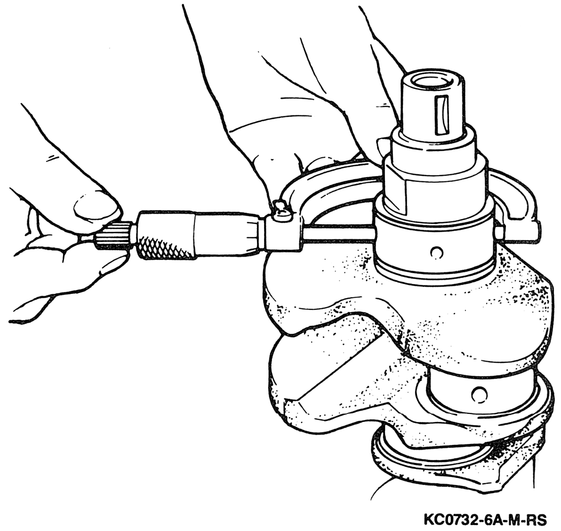


Figure 145 Checking Uneven Wear

1. If the ring gear is damaged, cracked, or worn, replace the flywheel.
2. If the surface contacting the clutch disc is damaged, or excessively worn, replace the flywheel.
3. Check the flywheel for face runout with a gage (Figure 146). If the runout is out of the limit, replace the flywheel.

CYLINDER BLOCK

Inspect

Limit on Runout	0.2 mm 0.0078 in

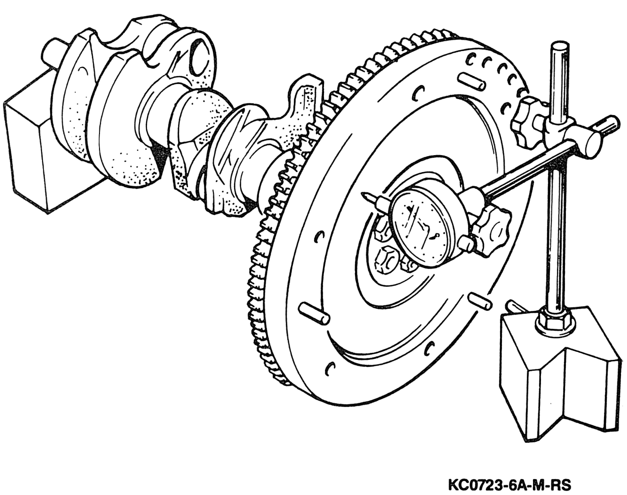


Figure 146 Measuring Runout

Flatness of Gasketed Surface

Using a straight-edge and a thickness gage, check the gasketed surface for flatness and, if the flatness exceeds the limit, correct it.

Horning or Reboring Cylinders

1. When any cylinder needs reboring, all other cylinders must also be rebored at same time.
2. Select oversized piston according to amount of cylinder wear.
3. Using micrometer, measure the piston diameter.
4. Calculate the cylinder bore diameter to be rebored. D = A + B - C D : Cylinder bore diameter to be rebored. A : Piston diameter as measured. B : Piston clearance = 0.02 - 0.04 mm (0.0008 -= 0.0015 in.). C : Allawance for honing = 0.02 mm (0.0008 in.)
5. Rebore and hone cylinder to calculated dimension.
   Groove

NOTICE: Before reboring, install all main bearing caps in place and tighten to the specification to avoid distortion of bearing bores.

6. Measure piston clearance after honing.

Install or Connect

NOTICE:

- All parts to be installed must be perfectly clean.
- Be sure to oil crankshaft journals, journal bearings, thrust bearings, crankpins, connecting rod bearings, pistons, piston rings, and cylinder bores.
- Journal bearings, bearing caps, connecting rods, rod bearings, rod bearing caps,

	Standard	Limit
Flatness	0.03 mm 0.0012 in	0.06 mm 0.0024 in

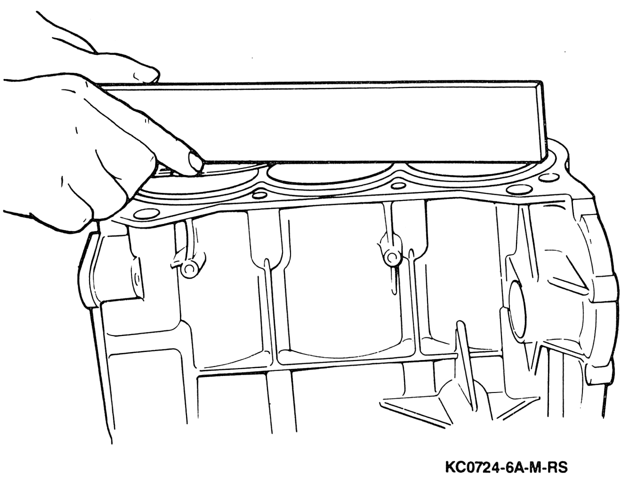
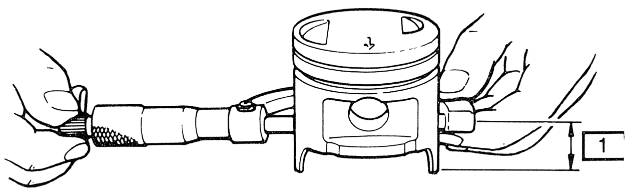


Figure 147 Checking Flatness at Surface

Size	Piston Diameter
O/S 0.25	74.220 — 74.230 mm 2.9220 — 2.9224 in
O/S 0.50	74.470 — 74.480 mm 2.9318 — 2.9322 in

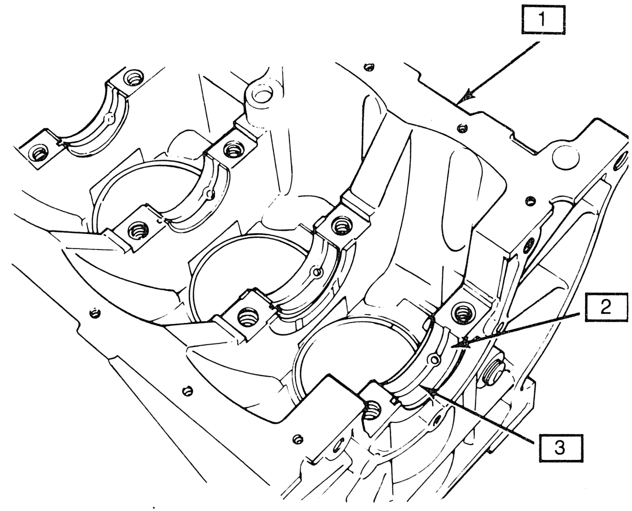


1 11.5 mm (0.45 in.) FOR METRO LS1
15mm (0.6 in.) FOR METRO BASE

Figure 148 Measuring Piston Diameter

pistons, and piston rings are in combination sets. Do not disturb the combination and check to see that each part goes back to where it came from, when installing.

1. Main bearings to cylinder block: Install the half with oil groove to cylinder block.
2. Thrust bearings to cylinder bolck between No. 2 and No. 3 cylinders. Face th oil groove sides to counterweights. (Figure 150).
3. Crankshaft to cylinder block.
4. When fitting the bearing caps to journals after setting the crankshaft in place, be sure to point the arrow mark (on each cap) to crankshaft pulley side. Fit them sequentially in order, 1, 2, 3 and 4, starting from pulley side.



1 CYLINDER BLOCK
2 UPPER HALF OF BEARING
3 OIL GROOVE

Figure 149 Bearing Installing Half With Oil

Important

- Gradual and uniform tightening is important for bearing cap bolts.
- After tightening cap bolts, check to be sure that crankshaft rotates smoothly when turn over by hand.

5. Oil seal housing and gasket. Install new gasket. DO NOT reuse old gasket. Oil the portion of oil seal before installing. Among five housing bolts, two No. 1 bolts and one No. 2 bolt are shorter than two No. 3 bolts in length. The thread of new NO. 2 bolt is coated with sealant. Apply to the thread of No. 2 bolt only when reusing. After the oil seal housing, the gasket edges might bulge out; if so cut off the edges to flush with cylinder block and oil seal housing.

Tighten

- Housing bolts to 12 N·m (9 lb.ft.).

6. Oil pump: Refer to "OIL PUMP" for installation of oil pump procedure in this section.
7. Flywheel: Using a flywheel holder, hold the flywheel, and tighten the flywheel bolts to specification 61 N·m (45 lb.ft.).
8. Pistons and connecting rods as previously outlined.
9. Oil pump strainer and oil pan.
10. Cylinder head assembly to cylinder block. Before installing cylinder head assembly to cylinder block, install check valve into oil gallary in cylinder block, directing slit of valve toward top of cylinder block.

NOTICE:

- Tighten cylinder head bolts to specified torque as previously outlined. Whenever installing cylinder head to new engine

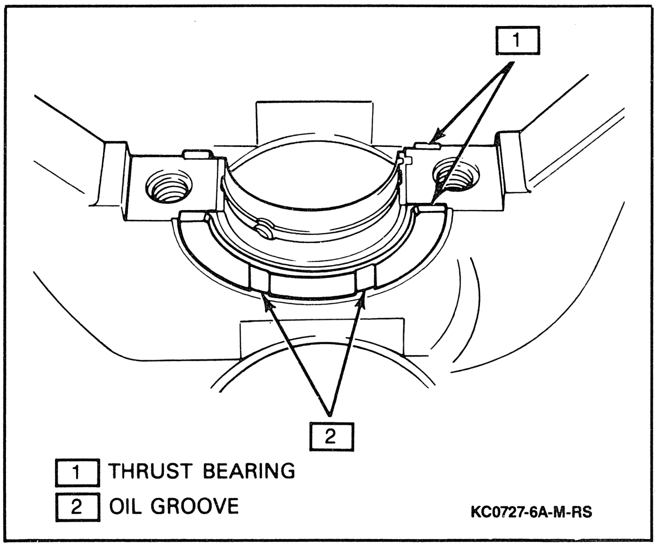

1
2
1 THRUST BEARING
2 OIL GROOVE
KC0727-6A-M-RS

Figure 150 Installing Thrust Bearings

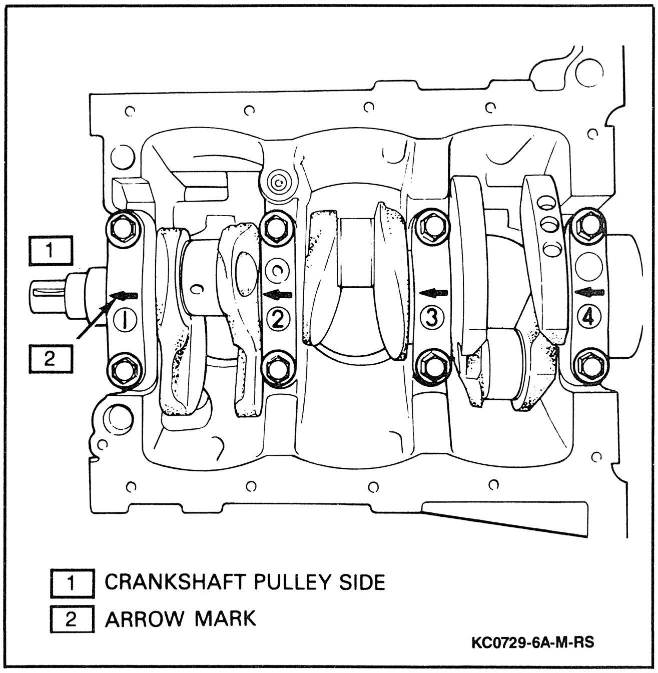

1
2
①
②
③
④
1 CRANKSHAFT PULLEY SIDE
2 ARROW MARK
KC0729-6A-M-RS

Figure 151 Installing Main Bearing Caps

block, use following procedure to tighten engine head bolts.

- Tighten cylinder head bolts to specified torque as previously outlined and loosen them once till tightening torque becomes "zero". Then torque them to specification again.

11. Crankshaft timing belt gear, timing belt, crankshaft pulley, water pump pulley, etc., as previously outlined.
12. Clutch to flywheel (M/T model). For clutch installation, refer to CLUTCH (Section 7C).
13. Engine with transmission to body as previously outlined.

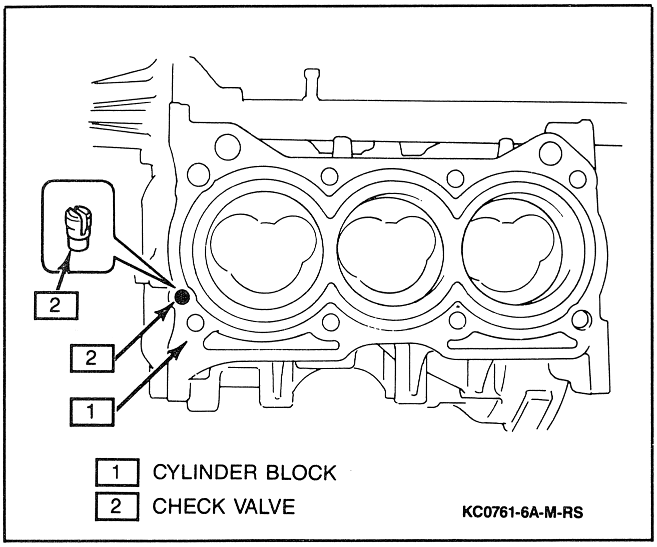

2
2
1
1 CYLINDER BLOCK
2 CHECK VALVE
KC0761-6A-M-RS

Figure 152 Inserting Check Valve

REAR MAIN SEAL

Remove or Disconnect

1. Transaxle as outlined in TRANSMISSION (Section 7A1) or (Section 7B).
2. Clutch pressure plate and driven disc (M/T only).
3. Flywheel.
4. Remove seal.

Install or Connect

1. New seal.
2. Flywheel.
3. Clutch pressure plate and driven disc (M/T only).
4. Transaxle.

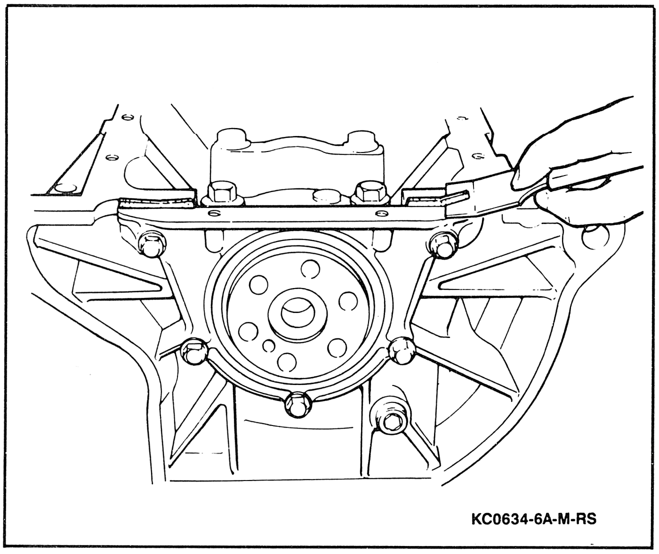

KC0634-6A-M-RS

Figure 153 Cutting Off Edges of Gasket

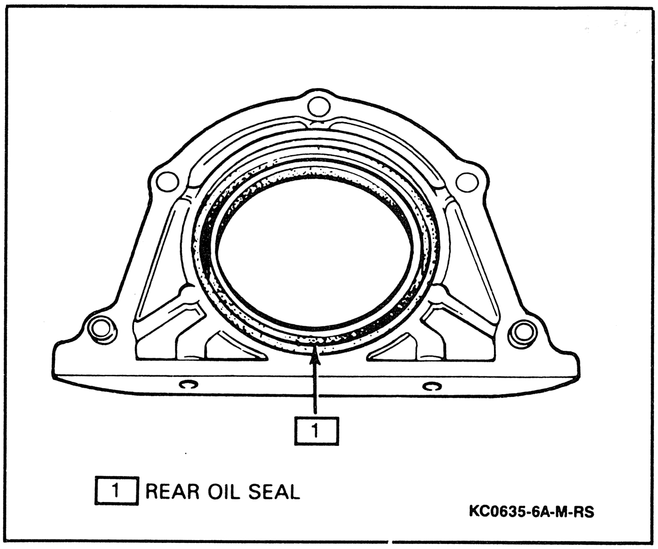
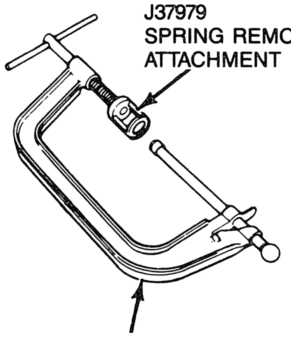
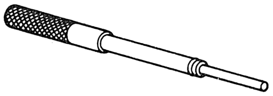

1
1 REAR OIL SEAL
KC0635-6A-M-RS

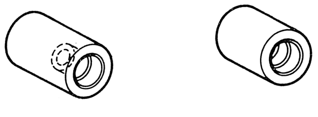
Figure 154 Rear Oil Seal

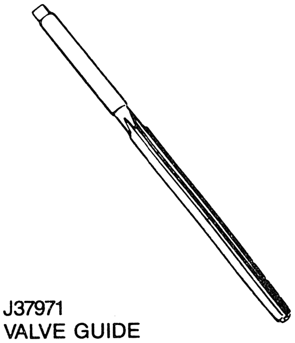
SPECIAL TOOLS

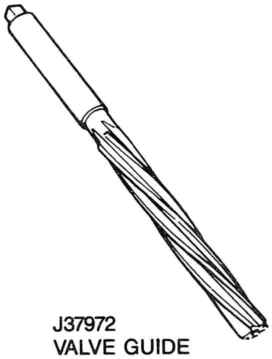

J37979
SPRING REMOVER
ATTACHMENT

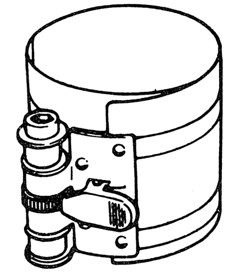
J8062
VALVE LIFTER

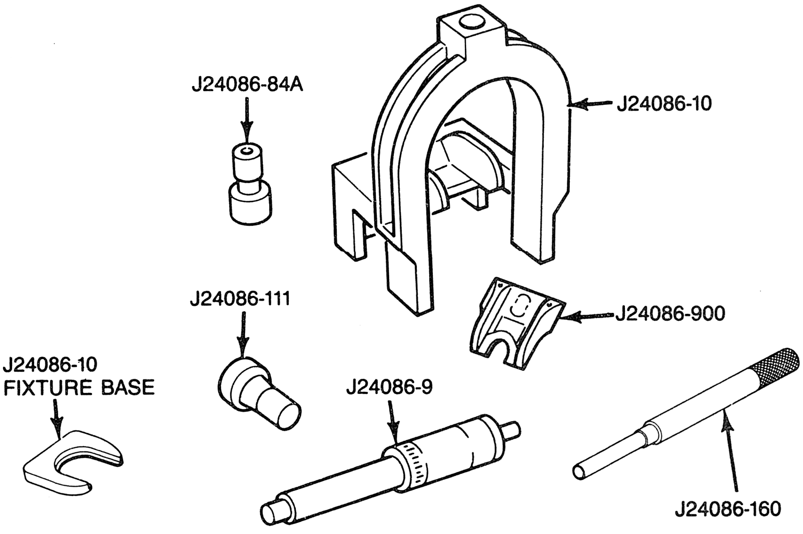

J37968-1
VALVE GUIDE
REMOVER


J37968-2
VALVE GUIDE
INSTALLER AND
VALVE STEM
SEAL INSTALLER


J37971
VALVE GUIDE
REAMER


J37972
VALVE GUIDE
REAMER


J8037
PISTON RING
COMPRESSOR


J24086-84A
J24086-10
J24086-111
J24086-900
J24086-10
FIXTURE BASE
J24086-9
J24086-160

J24086-900
SUPPORT FORK

J24086-9
INSTALLATION ARBOR

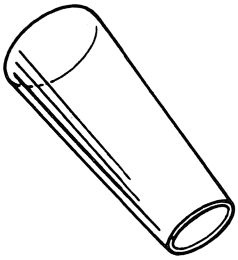
J4086-110
REMOVAL ARBOR

J24086-160
SUPPORT FORK
INSERT

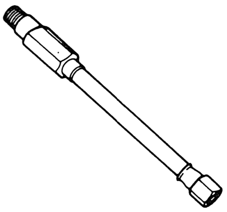
J24086-84A
GUIDE PIN

J4086-111
INSTALLATION
ADAPTER

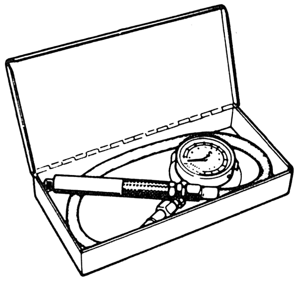
KC0607-6A-M-RS



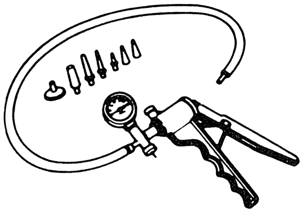
J34853
CRANKSHAFT
OIL SEAL GUIDE



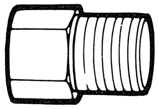
J22794
COMPRESSION
GAUGE ADAPTER



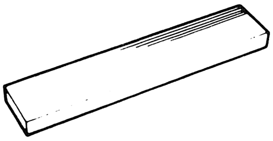
J21867
OIL PRESSURE
GAUGE



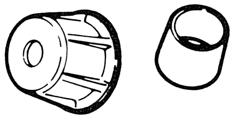
J23738-A
VACUUM PUMP



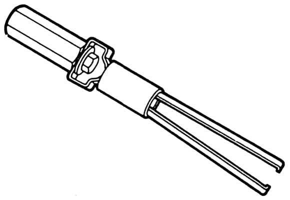
J25695-10
OIL PRESSURE
GAUGE ADAPTER



J34673
STRAIGHT
EDGE



J37748
CRANKSHAFT
SEAL INSTALLER WITH
J37747 SLEEVE



J37281-A
VALVE STEM OIL
SEAL REMOVER

KC0636-6A-M-RS

TORQUE SPECIFICATIONS

Specifications Torque

Cylinder Head Bolt	73 N·m (54 lb.ft.)
Spark Plug	25 N·m (18 lb.ft.)
Intake and Exhaust Manifold Nut	23 N·m (17 lb.ft.)
Camshaft Timing Gear Bolt	60 N·m (44 lb.ft.)
Timing Belt Cover Bolt and Nut	11 N·m (8 lb.ft.)
Crankshaft Pulley Bolts	11 N·m (8 lb.ft.)
Connecting Rod Bearing Cap Nut	35 N·m (26 lb.ft.)
Crankshaft Main Bearing Cap Bolt	54 N·m (40 lb.ft.)
Flywheel Bolt	61 N·m (45 lb.ft.)
Oil Pressure Switch	14 N·m (10 lb.ft.)
Oil Filter Stand	23 N·m (17 lb.ft.)
Oil Pan Bolt and Nut	11 N·m (8 lb.ft.)
Oil Drain Plug	35 N·m (26 lb.ft.)
Cylinder Head Cover Bolt	5 N·m (4 lb.ft.)
Camshaft Housing Bolt	11 N·m (8 lb.ft.)
Exhaust No. 1 Pipe Bolt	50 N·m (37 lb.ft.)
Oil Pump Strainer Bolt	11 N·m (8 lb.ft.)
Oil Pump Case Bolt	11 N·m (8 lb.ft.)
Crankshaft Timing Belt Gear Bolt	110 N·m (81 lb.ft.)
Timing Belt Tensioner Bolt	27 N·m (20 lb.ft.)
Timing Belt Tensioner Stud	11 N·m (8 lb.ft.)
Oil Pump Rotor Plate Screw	11 N·m (8 lb.ft.)

SECTION 6B

ENGINE COOLING

CONTENTS

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Water Pump 6B-6
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Fan Thermo Switch 6B-8
Radiator 6B-8

GENERAL DESCRIPTION

The cooling system consists of the radiator, the cap, water reservoir tank, hoses, water pump, cooling fan and thermostat. The radiator is of the tube-and-fin type.

COOLING SYSTEM CIRCULATION

During engine warm-up (thermostat closed), the water pump discharges coolant into the water jacket chamber adjacent to No. 1 cylinder.

Coolant then flows through the cylinder block and the cylinder head. Coolant then returns to the water pump through intake manifold, heater inlet hose, heater unit, heater outlet hose, and water intake pipe.

During normal temperatures (thermostat open), coolant takes the same basic route but is now allowed to flow past the thermostat, the inlet hose and the radiator, and then back to the water pump through the outlet hose and the water intake pipe.

RADIATOR CAP

A pressure-vent cap is used on the radiator. The cap contains a pressure valve and vacuum valve. The pressure valve is held against its seat by a spring of pre-determined strength which protects the cooling system by relieving the pressure if the pressure in the cooling system rises by 0.9 kg/cm^2 (12.8 psi, 90 Kpa). The vacuum valve is held against its seat by a light spring which permits opening of the valve to relieve vacuum created in the system when it cools off and which otherwise might cause the radiator to collaspe.

Do not remove radiator cap to check engine coolant level; check coolant visually at the see-through water reservoir tank.

Coolant should be added only to the reservoir tank as necessary.

CAUTION: As long as there is pressure in the cooling system, the temperature can be considerably higher than the boiling temperature of the solution in the radiator without causing the solution to boil. Removal of the radiator cap while engine is hot and pressure is high will cause the solution to boil instantaneously and possibly with explosive force, spewing the solution over engine, fenders and person removing cap. If the solution contains flammable anti-freeze such as alcohol (not recommended for use at any time), there is also the possibility of causing a serious fire.

WATER RESERVOIR TANK

A "see-through" plastic reservoir tank is connected to the radiator by a hose. As the car is driven, the coolant is heated and expands. The portion of the coolant displaced by this expansion flows from the radiator into the reservoir tank. When the car is stopped and the coolant cools and contracts, the displaced coolant is drawn back into the radiator by vacuum.

Thus, the radiator is kept filled with coolant to the desired level at all times, resulting in increased cooling efficiency.

Coolant level should be between "FULL" and "LOW" marks on the reservoir tank.

Coolant should be added only to the reservoir tank as necessary.

WATER PUMP

The centrifugal type water pump is used in the cooling system. The pump impeller is supported by a totally sealed bearing. The water pump can not be disassembled.

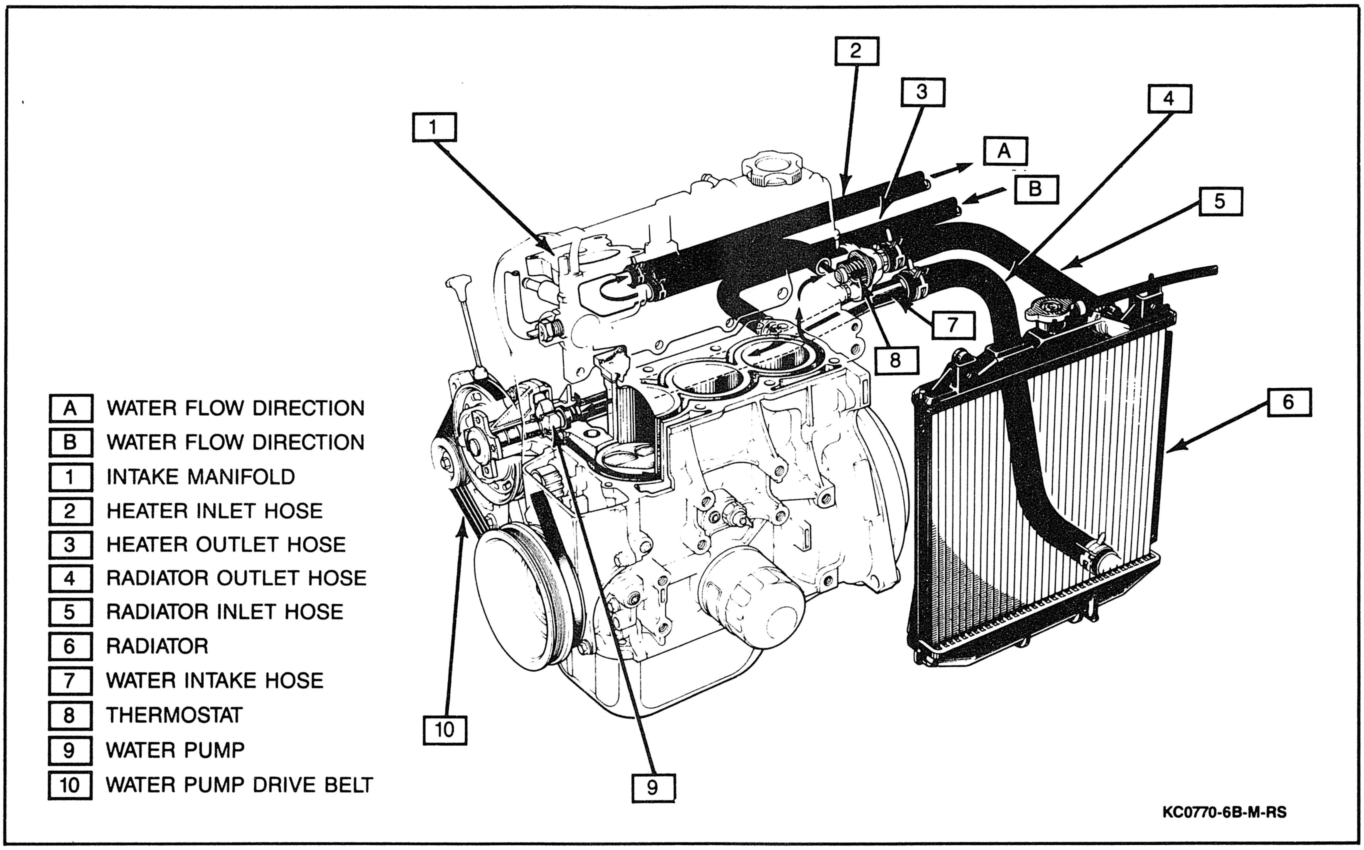

1
2
3
4
5
6
7
8
9
10
A
B
A WATER FLOW DIRECTION
B WATER FLOW DIRECTION
1 INTAKE MANIFOLD
2 HEATER INLET HOSE
3 HEATER OUTLET HOSE
4 RADIATOR OUTLET HOSE
5 RADIATOR INLET HOSE
6 RADIATOR
7 WATER INTAKE HOSE
8 THERMOSTAT
9 WATER PUMP
10 WATER PUMP DRIVE BELT
KC0770-6B-M-RS

Figure 6B-1 Cooling System

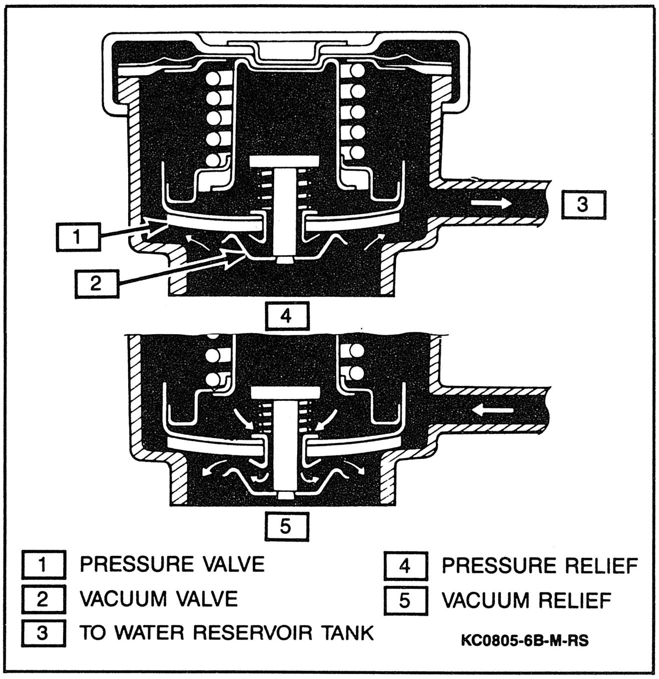

1
2
3
4
5
1 PRESSURE VALVE
2 VACUUM VALVE
3 TO WATER RESERVOIR TANK
4 PRESSURE RELIEF
5 VACUUM RELIEF
KC0805-6B-M-RS

Figure 6B-2 Pressure Type Radiator Cap

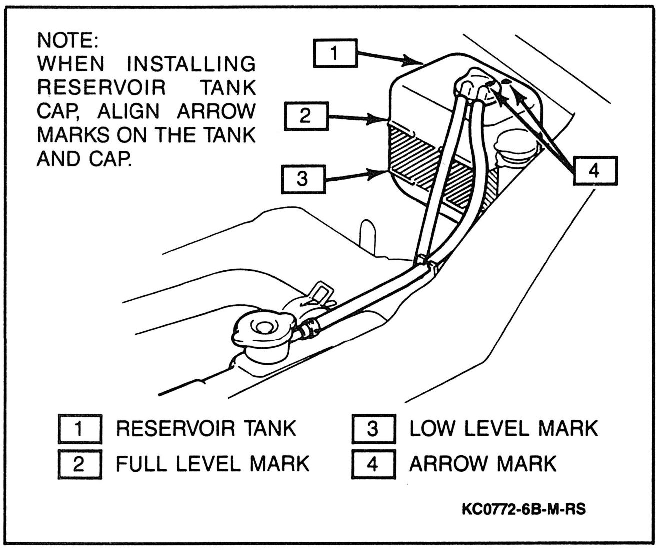

NOTE:
WHEN INSTALLING RESERVOIR TANK CAP, ALIGN ARROW MARKS ON THE TANK AND CAP.
1
2
3
4
1 RESERVOIR TANK
2 FULL LEVEL MARK
3 LOW LEVEL MARK
4 ARROW MARK
KC0772-6B-M-RS

Figure 6B-3 Water Reservoir Tank

THERMOSTAT

A wax pellet type thermostat is used in the coolant outlet passage to control the flow of engine coolant, to provide fast engine warm up and to regulate coolant temperatures.

A wax pellet element is hermetically contained in a metal case, and expands when heated and contracts when cooled.

When the pellet is heated and expands, the metal case pushes down the valve to open it.

As the pellet is cooled, the contraction allows a spring to close the valve.

Thus, the valve remains closed while the coolant is cold, preventing circulation of coolant through the radiator.

At this point, coolant is allowed to circulate only throughout the engine to warm it quickly and evenly.

As the engine warms, the pellet expands and the thermostat valve opens, permitting coolant to flow through the radiator.

In the top portion of the thermostat, an air bleed valve is provided; this valve is for venting out the gas or air, if any, that is accumulated in the circuit.

There are two types of thermostats, A and B as shown in chart.

Either one is used depending on vehicle specifications. The temperature at which the valve begins to open is stamped on each thermostat. Be sure to note this stamped temperature for replacement.

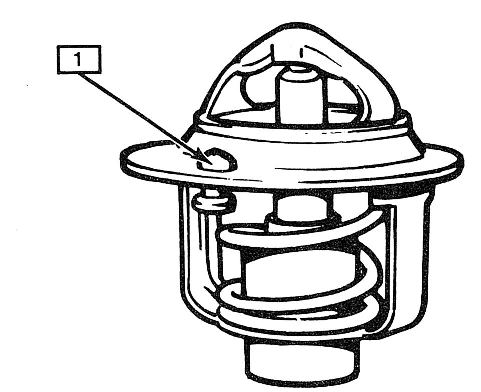


Figure 6B-4 Thermostat

Thermostat functional spec. ± 1.5°C (2.7°F)		
Thermostat	"A"	"B"
Temp. at which valve begins to open	88°C (190°F)	92°C (197°F)
Temp. at which valve becomes fully open	100°C (212°F)	105°C (221°F)

KC0775-6B-M-RS

COOLING FAN

The cooling fan is driven by electric motor, and the motor is activated by thermo switch.

The temperature at which the thermo switch is on or off depends on which thermostat is in the vehicle. See chart below.

Fan thermo switch functional spec. ± 5°C (9°F)		
Switch for Thermostat	"A"	"B"
Temp. at switch "ON"	More than 98°C (208°F)	More than 102°C (215°F)
Temp. at switch "OFF"	Less than 93°C (199°F)	Less than 97°C (206°F)

LC0001-6B-M-RS

CAUTION: Keep hands, tools, and clothing away from engine cooling fan to help prevent personal injury. This fan is electric and can come on whether or not the engine is running. The fan can start automatically in response to the thermo switch with the ignition switch in the "ON" position.

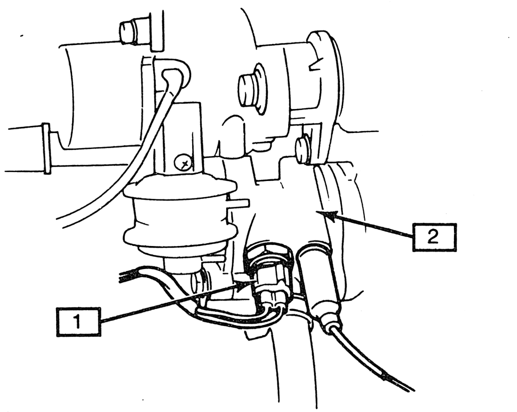


Figure 6B-5 Thermo Switch

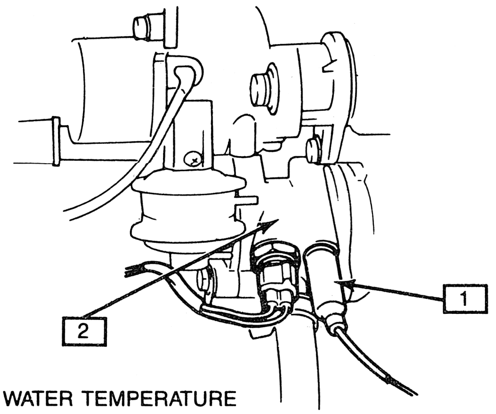


Figure 6B-6 Water Temp Gauge

WATER TEMPERATURE GAGE

A water gage is located at the thermostat case. This gage activates a temperature meter gage in the instrument cluster.

DIAGNOSIS

Condition	Possible Cause	Correction
Engine overheats	● Loose or broken water pump belt	Adjust or replace.
	● Not enough coolant	Check coolant level and add as necessary.
	● Faulty thermostat	Replace.
	● Faulty water pump	Replace.
	● Dirty or bent radiator fins	Clean or remedy.
	● Coolant leakage in Cooling System	Repair.
	● Defective cooling fan motor or thermo switch	Check and replace as necessary.
	● Plugged radiator	Check and replace radiator as necessary.
	● Faulty radiator cap	Replace.
	● Maladjusted ignition timing	Adjust.
	● Dragging brakes	Adjust brake.
	● Slipping clutch	Adjust or replace.

MAINTENANCE

COOLANT SYSTEM

The coolant recovery system is standard. The coolant in the radiator expands with heat, and the overflow is collected in the reservoir tank. When the system cools down, the coolant is drawn back into the radiator.

The cooling system has been filled at the factory with a quality coolant that is a 50/50 mixture of water and ethylene glycol antifreeze.

This coolant solution provides freezing protection to -36°C (-33°F).

- Maintain cooling system freeze protection at -36°C (-33°F) to ensure protection against corrosion and loss of coolant from boiling. This should be done even if freezing temperatures are not expected.
- Add ethylene glycol base coolant, when coolant has to be added because of coolant loss or to provide added protection against freezing at temperature lower than -36°C (-33°F).

NOTICE: Alcohol or methanol base coolants or plain water alone should not be used in the cooling system at any time, as damage to the cooling system could occur.

COOLANT LEVEL

Refer to your Owner's Manual for the correct procedures on coolant level.

COOLING SYSTEM SERVICE

CAUTION: To help avoid the danger of being burned: do not remove the reservoir tank cap while the coolant is "boiling", and do not remove the radiator cap while the engine and radiator are still hot. Scalding fluid and steam can be blown out under pressure if either cap is taken off too soon.

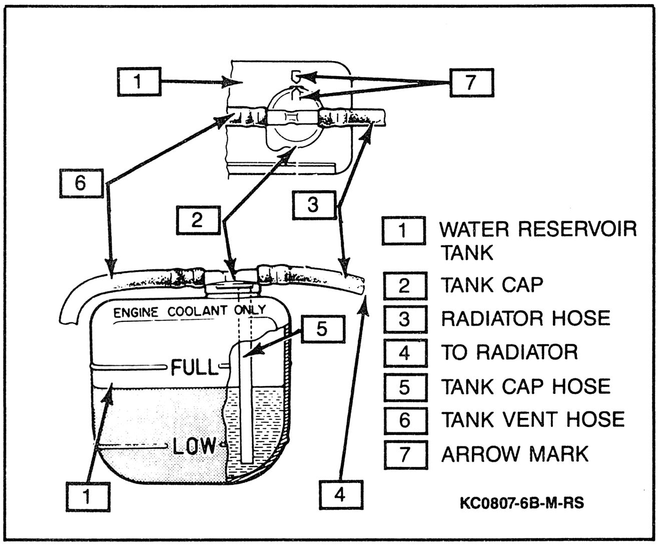


Figure 6B-7 Water Reservoir Tank

The cooling system should be serviced as follows:.

1. Check the cooling system for leaks or damage.
2. Wash radiator cap and filler neck with clean water by removing the radiator cap when engine is cold.
3. Check coolant for proper level and freeze protection.

4. Using a pressure tester, check the system and radiator cap for proper pressure holding capacity 0.9 kg/cms (12.8 psi, 90 kPa). If replacement of cap is required, use the proper cap specified for this vehicle.
5. Tighten hose clamps and inspect all hoses. Replace hoses whenever checked, swollen or otherwise deteriorated.
6. Clean frontal area of radiator core.

After installing the radiator cap to the radiator, make sure that its ear is aligned with the reservoir tank hose as shown in Figure 6B-8. If not, turn the cap more to align the ear with the hose.

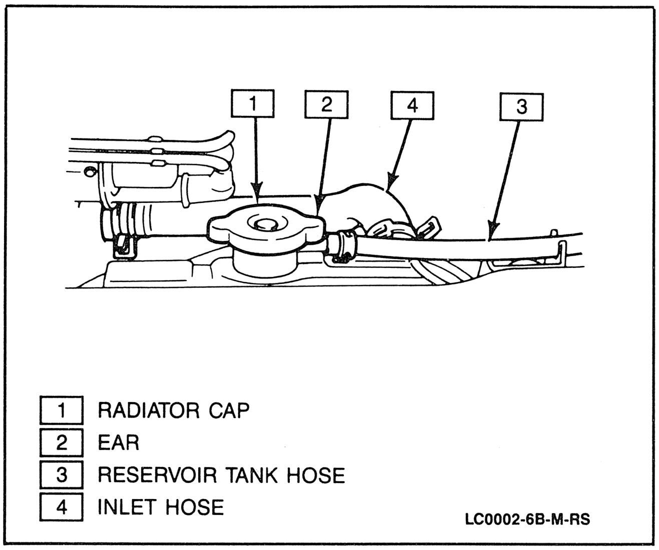


Figure 6B-8 Installation of Radiator Cap

COOLING SYSTEM DRAINING, FLUSHING AND REFILLING

Refer to Section 0B for correct refill intervals.

1. Remove radiator cap when engine is cool:
    - Turn cap slowly to the left until it reaches a "stop" (Do not press down while turning the cap).
    - Wait until pressure is relieved (indicated by a hissing sound): then press down on cap and continue to rotate to the left.

CAUTION: To help avoid the danger of being burned, do not remove the radiator cap while the engine and radiator are still hot. Scalding fluid and steam can be blown out under pressure if the cap is taken off too soon.

2. With radiator cap removed, run the engine until upper radiator hose is hot (this shows that the thermostat is open and the coolant is flowing through the system).
3. Stop engine and open radiator drain plug to drain coolant.
4. Close drain plug. Add water until system is filled and run engine until the upper radiator hose is hot again.
5. Repeat steps 3, and 4 several times until the drained liquid is nearly colorless.
6. Drain system and then close radiator drain plug tightly.
7. Disconnect hose from the water reservoir tank. Remove the tank and pour out any fluid. Clean the inside of the tank with soap and water. Flush it well with clean water and drain. Reinstall the tank and hose.
8. Add 50/50 mixture of a good quality enthylene glycol antifreeze and water to the radiator and the tank.
   Fill radiator to the base of the radiator filler neck and the reservoir tank to the "FULL" level mark. Reinstall the reservoir tank cap.
9. Run engine, with radiator cap removed, until radiator upper hose is hot.
10. With engine idling, add coolant to radiator until level reaches the bottom of filler neck. Install the radiator cap, making sure allows the ear of cap line up with the reservoir tank hose.

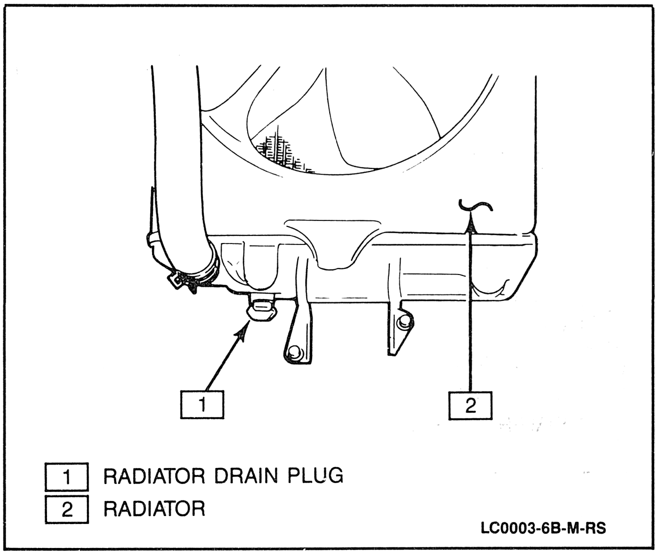


Figure 6B-9 Radiator Drain Plug

ON-VEHICLE SERVICE

COOLING WATER PIPES OR HOSES

Remove or Disconnect

1. Drain cooling system.
2. To remove these pipes or hoses, loosen screw on each pipe or hose clip and pull hose end off.

Install of Connect

Install removed part A in reverse order of removal procedure, noting the following:

- Tighten each clamp bolt securely.
- Refill cooling system with proper coolant.

WATER PUMP BELT TENSION

1. Disconnect negative battery cable.
2. The belt is in proper tension when a thumb pressure (10 kg (98 N) applied to the middle point between water pump pulley and crankshaft pulley deflects it 6 to 8 mm (0.25 to 0.35 in).
3. If the tension is out of specification, adjust it. Remove the generator cover and then loosen the arm bolt, generator bolt and generator nut, and adjust the generator to slacken or tighten the belt.

   After adjustment, tighten bolts and nut and reinstall the generator cover.
4. Connect negative battery cable.

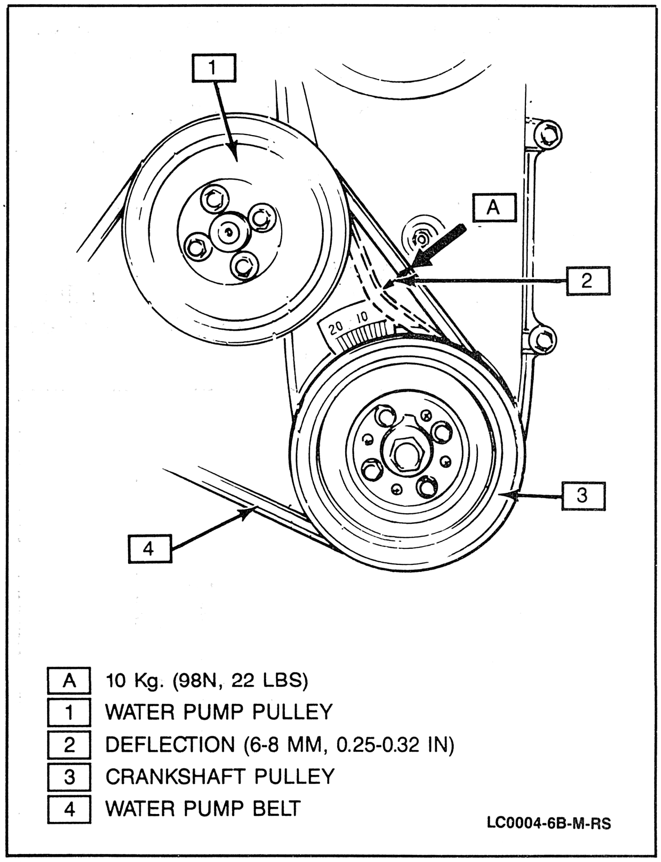

1
A
2
20 10
3
4
A 10 Kg. (98N, 22 LBS)
1 WATER PUMP PULLEY
2 DEFLECTION (6-8 MM, 0.25-0.32 IN)
3 CRANKSHAFT PULLEY
4 WATER PUMP BELT
LC0004-6B-M-RS

Figure 6B-10 Water Pump Belt Tension

WATER PUMP

Remove or Disconnect

1. Negative cable at battery.
2. Drain the cooling system.
3. Water pump belt, water pump pulley, crank shaft pulley, timing belt outside cover, timing belt, timing belt tensioner, and engine right side under cover.
4. Remove the water pump attaching bolts and nuts, and then remove the pump.

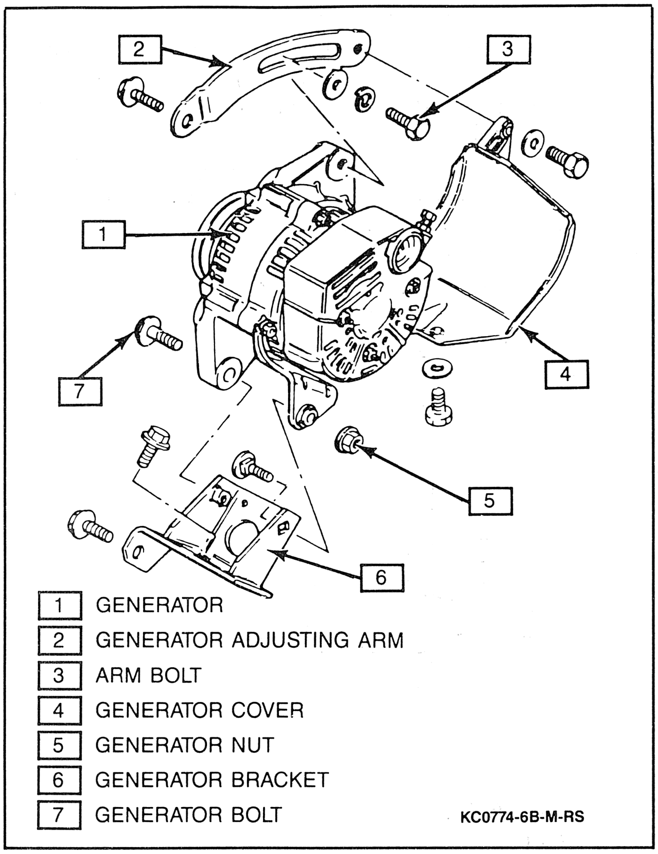

2
3
1
4
7
5
6
1 GENERATOR
2 GENERATOR ADJUSTING ARM
3 ARM BOLT
4 GENERATOR COVER
5 GENERATOR NUT
6 GENERATOR BRACKET
7 GENERATOR BOLT
KC0774-6B-M-RS

Figure 6B-11 Arm Bolt and Generator Bolt and Nut

Inspect

Do not disassemble the water pump. If any repair is required on the pump, replace it as assembly.

- Rotate the water pump by hand to check for smooth operation.
  If the pump does not rotate smoothly or makes an abnormal noise, replace it.

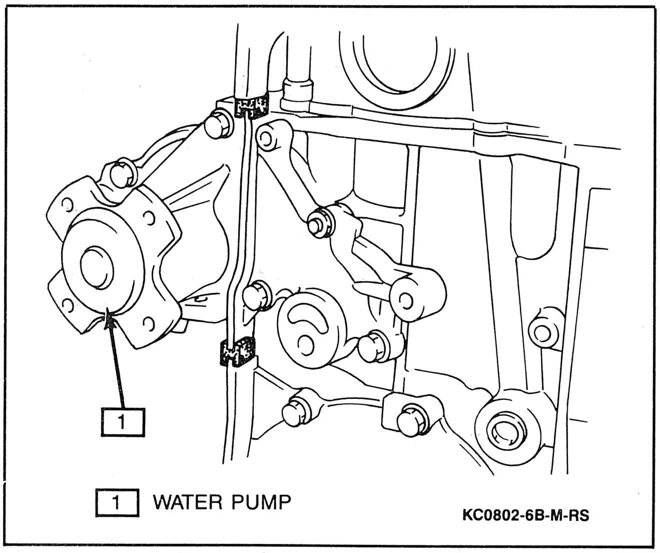

1
1 WATER PUMP
KC0802-6B-M-RS

Figure 6B-12 Water Pump

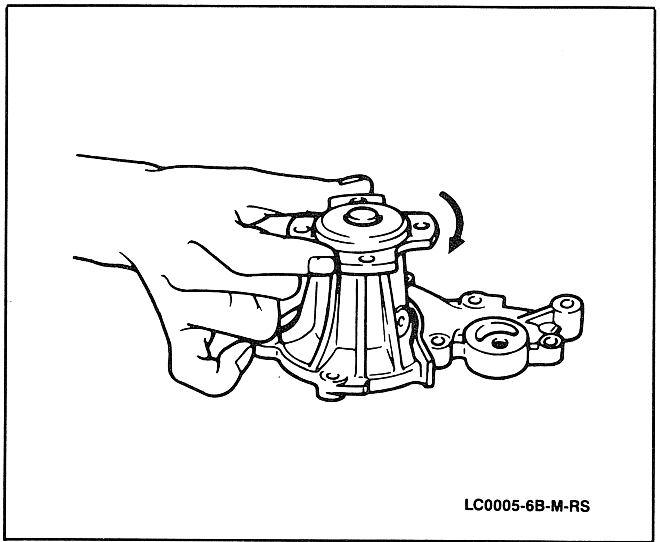
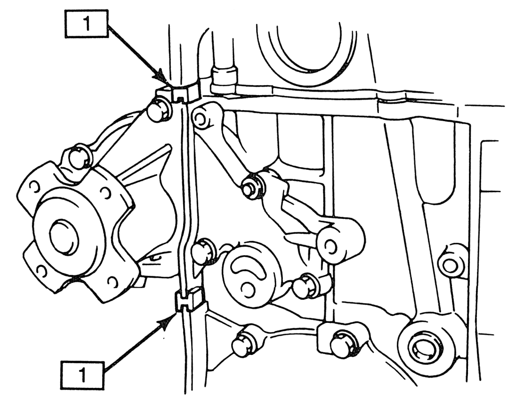


Figure 6B-13 Checking Water Pump

Install or Connect

1. New water pump gasket to cylinder block.
2. Water pump to cylinder block.
   After installing the water pump, install rubber seals between water pump and oil pump, and between water pump and cylinder head.



TIGHTENING TORQUE FOR BOLTS AND NUTS	10 – 13 N•m 1.0 – 1.3 Kg-m 7.5 – 9.0 lb.-ft.

LC0006-6B-M-RS

Figure 6B-14 Installing Rubber Seals

3. Belt tensioner, timing belt, adjust timing belt, timing belt outside cover, crank shaft pulley, water pump pulley, water pump, and engine right side under cover.
   Tense the water pump belt to the specification when installing it.
4. Fill the cooling system.
5. Negative cable at battery.

THERMOSTAT

Remove or Disconnect

1. Negative cable at battery.
2. Drain cooling system.
3. Air cleaner.
4. Radiator inlet hose at thermostat cap.
5. Thermostat cap and thermostat.

Inspect

1. Make sure that the air bleed valve of the thermostat is clear. Should this valve be clogged, the engine would tend to overheat.

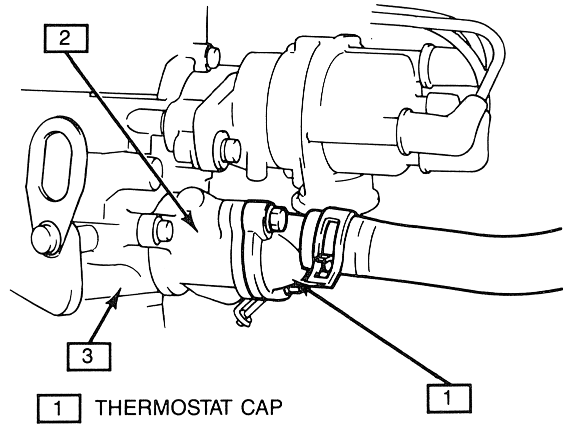


Figure 6B-15 Thermostat Cap and Thermostat

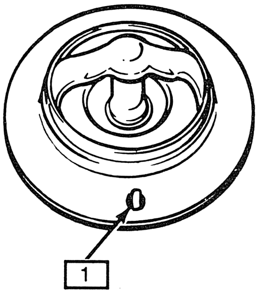


Figure 6B-16 Air Bleed Valve of Thermostat

2. Check the valve seat for some foreign matters being stuck which prevents the valve from seating tight.
3. Check the thermostatic movement of the was pellet as follows:
   - Immerse the thermostat in water, and heat water gradually.

- Check that valve starts to open at 88° (190°F).
- If the valve starts to open at a temperature substantially below or above, the thermostat unit should be replaced by a new one. Such a unit, if re-used, will bring about overcooling or overheating tendency.

Install or Connect

1. Thermostat to intake manifold as shown in Figure 6B-18.
2. Gasket and thermostat cap to intake manifold.

   Use a new gasket.
3. Radiator inlet hose.
4. Air cleaner.
5. Refill cooling system.
6. Negative cable at battery.

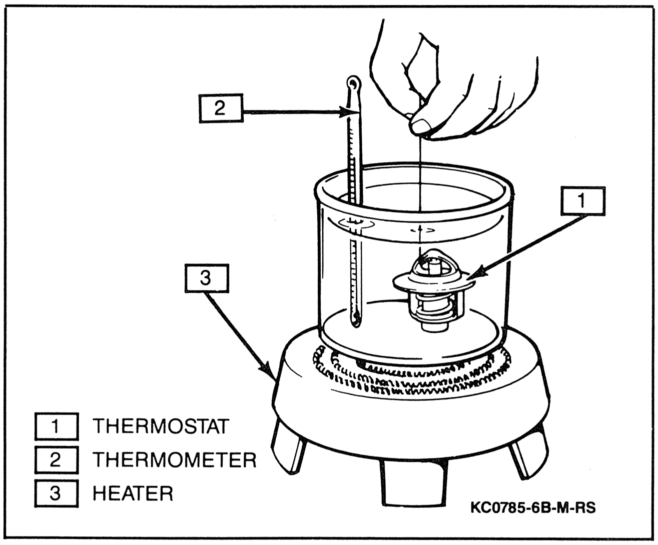

2
1
3
1 THERMOSTAT
2 THERMOMETER
3 HEATER
KC0785-6B-M-RS

Figure 6B-17 Checking Thermostat Valve Operation

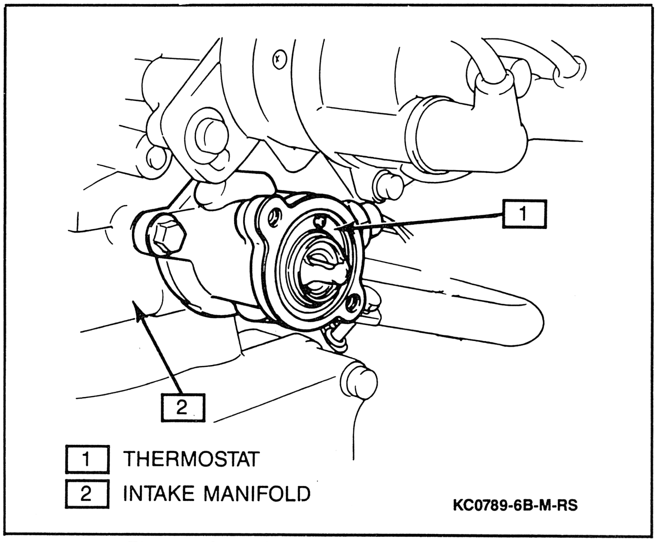

1
2
1 THERMOSTAT
2 INTAKE MANIFOLD
KC0789-6B-M-RS

Figure 6B-18 Installing Thermostat

FAN THERMO SWITCH

Remove or Disconnect

1. Negative cable at battery.
2. Drain cooling system.
3. Air cleaner.
4. Disconnect connector of thermo switch lead wire.
5. Thermo switch from thermostat case.

Install or Connect

Wind the sealing tape on the screw threads of thermo switch before installing the switch to thermostat cap.

Reverse removal procedure.

Inspect

1. Connect an ohmmeter to the thermo switch.
2. Immerse the switch in water, and heat water gradually.
3. Check that the switch turns "ON" or "OFF" according to the below specification. If switch is faulty, replace it.

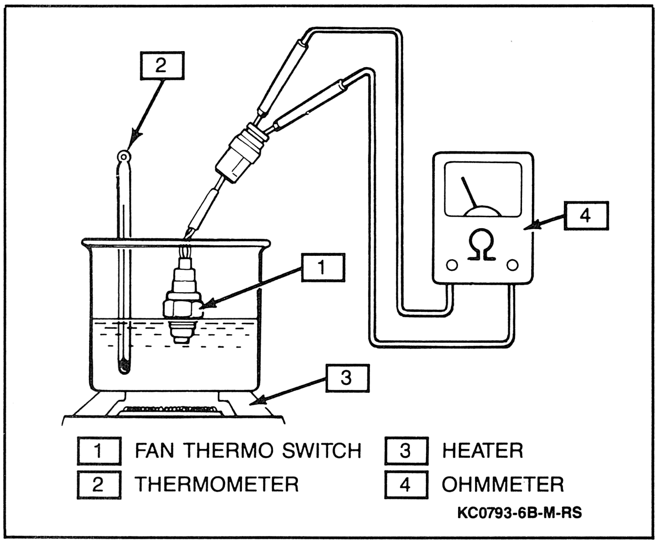

2
1
3
4
Ω
1 FAN THERMO SWITCH
2 THERMOMETER
3 HEATER
4 OHMMETER
KC0793-6B-M-RS

Figure 6B-19 Checking Fan Thermo Switch

Fan thermo switch functional spec. ± 5°C (9°F)		
Switch for thermostat	"A"	"B"
Temp. at switch "ON" (Continuity)	More than 98°C (208°F)	More than 102°C (215°F)
Temp. at switch "OFF" (No continuity)	Less than 93°C (199°F)	Less than 97°C (206°F)

LC0007-6B-M-RS

RADIATOR

Remove or Disconnect

1. Negative cable at battery.
2. Drain cooling system by removing the drain plug of radiator.

3. Lead wire at cooling fan motor.
4. Air cleaner inlet hose.
5. Radiator inlet and outlet hoses, and reservoir tank hose.
6. With automatic transmission (A/T) car, disconnect transmission cooling lines from radiator. Place a container under radiator to receive A/T fluid which will flow out when hose is disconnected.
7. Radiator and cooling fan motor from front upper and lower members.

Inspect

Check the radiator for leaks or damages. Straighten the bent fins, if any.

Clean

Clean the frontal area of radiator cores.

Install or Connect

Reverse removal procedures.

NOTICE: Refill cooling system with proper coolant. With automatic transmission car, fill A/T fluid up to specified level. After installation, check each joint for leakage.

SECTION 6C

FUEL SYSTEM

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GENERAL INFORMATION

When working on the fuel system there are several things to keep in mind.

1. Anytime the fuel system is being worked on, disconnect the negative battery cable except for those tests where battery voltage is required.
2. Always keep a dry chemical (Class B) fire extingisher near the work area.
3. Always use a backup wrench when loosening or tightening a flare nut fitting.
4. Replace all fuel lines with the same fuel lines and fittings that were removed.
5. Do not replace fuel lines with fuel hose.
6. On any TBI fuel system, always relieve the line pressure before any fuel system component service is completed.
7. A small amount of fuel may be released after a fuel hose or line is disconnected. In order to reduce chance of personal injury, cover the fitting to be disconnected with a shop cloth.
8. When installing any fuel system component which uses an "O" seal, lubricate "O" with engine oil prior to installation.
9. Note that fuel hose connection varies with respect to each tye of fuel line. Be sure to connect and clamp each hose correctly (Figure 1).
10. Do not attempt any repairs on the fuel system until service procedure and figures relating to that repair are checked.
11. Adhere to all Notices and Cautions.

The engine of this vehicle is designed to use only unleaded gasoline. Unleaded gasoline must be used for proper emission control system operation. Its use will also minimize spark plug fouling and extend engine oil life. Using leaded gasoline can damage the emission control system and could result in loss of emission warranty coverage.

This vehicle is also equipped with an evaporative emission system. The purpose of the system is to minimize the the escape of fuel vapors to the atmosphere. For information on this system, refer to DRIVEABILITY AND EMISSIONS (Section 6E).

FUEL METERING

Fuel metering on this vehicle is accomplished using throttle body injection (TBI).

Throttle Body Injection

With throttle body injection (TBI), an injection unit is placed on the intake manifold where the carburetor is normally mounted. The throttle body injection unit is computer controlled and supplies the correct amount of fuel during all engine operating conditions. For information relative to this system, refer to DRIVEABILITY AND EMISSIONS (Section 6E).

FUEL SYSTEM PRESSURE RELIEF

CAUTION:

- **To prevent personal injury or damage to the vehicle as the result of an accidental start, disconnect the battery negative (-) cable before performing service.**
- **To minimize the risk of fire and personal injury, relieve the fuel system pressure before servicing the fuel system components. Refer to "Fuel Pressure Relief Procedure" in this section.**
- **Catch any fuel that spills when disconnecting the fuel system parts. Use a shop cloth to cover fittings while loosening them. Place the cloth in an approved container when work is complete.**

1. Place gear shift lever in NEUTRAL position (manual transaxle equipped vehicles), or shift selector lever in the PARK position (automatic transaxle equipped vehicles). Set parking brake and block drive wheels.

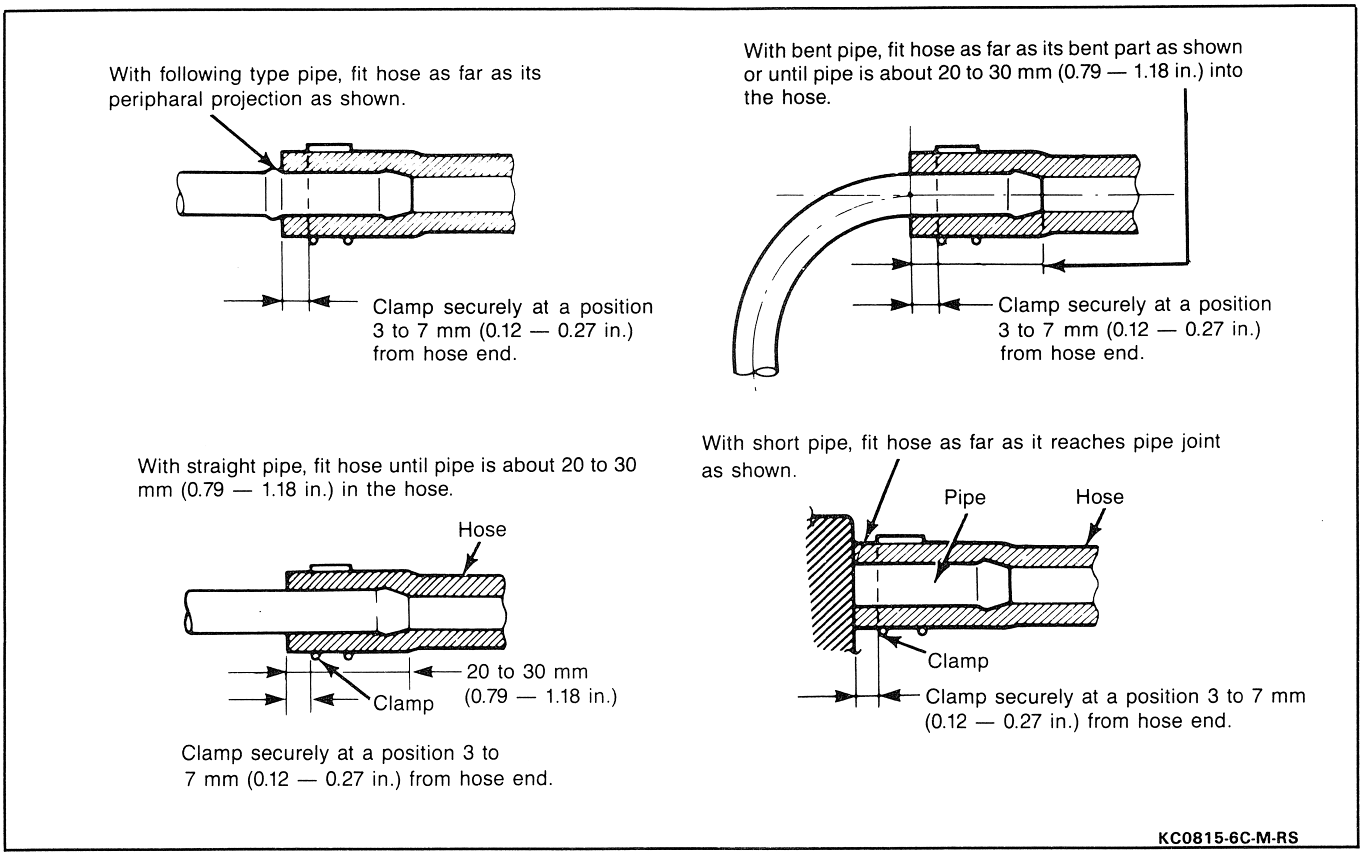

With following type pipe, fit hose as far as its peripharal projection as shown.
Clamp securely at a position 3 to 7 mm (0.12 — 0.27 in.) from hose end.
With bent pipe, fit hose as far as its bent part as shown or until pipe is about 20 to 30 mm (0.79 — 1.18 in.) into the hose.
Clamp securely at a position 3 to 7 mm (0.12 — 0.27 in.) from hose end.
With straight pipe, fit hose until pipe is about 20 to 30 mm (0.79 — 1.18 in.) in the hose.
Hose
20 to 30 mm (0.79 — 1.18 in.)
Clamp
Clamp securely at a position 3 to 7 mm (0.12 — 0.27 in.) from hose end.
With short pipe, fit hose as far as it reaches pipe joint as shown.
Pipe
Hose
Clamp
Clamp securely at a position 3 to 7 mm (0.12 — 0.27 in.) from hose end.
KC0815-6C-M-RS

Figure 1 Fuel Hose Connection Chart

2. Remove the fuel pump relay from the main fusebox (Refer to "Fuel Pump Relay Replacement" in this section).
3. Start engine, and allow it to stall. Crank engine two or three times for approximately three seconds each time to ensure fuel pressure dissipation within fuel lines.
4. Remove fuel filler cap from fuel filler neck to release fuel vapor pressure in the fuel tank. Reinstall the cap.

   CAUTION: If the pressure in the fuel tank is not released prior to system service, the fuel in the tank may be forced out through the fuel hoses or lines due to this pressure during disconnection.

5. Install the fuel pump relay to the main fusebox. Refer to "Fuel Pump Relay Replacement" in this section.
6. Fuel system components are now safe for servicing.

Fuel Leakage Check

When repair to the fuel system has been completed, apply fuel pressure to the system and check all connections that were loosened for possible leaks. Correct as necessary. For information on pressurizing fuel system, refer to DRIVEABILITY AND EMISSIONS (Section 6E).

FUEL SYSTEM

The fuel system main components include the fuel tank, fuel pump and sending unit mounted within the fuel tank, fuel filter, 2-way check valve mounted to the top of the fuel tank, fuel filler neck and cap, fuel feed line, fuel return line, fuel breather hose, and fuel vapor line which connects to a vapor storage canister mounted in the engine compartament (Figure 2).

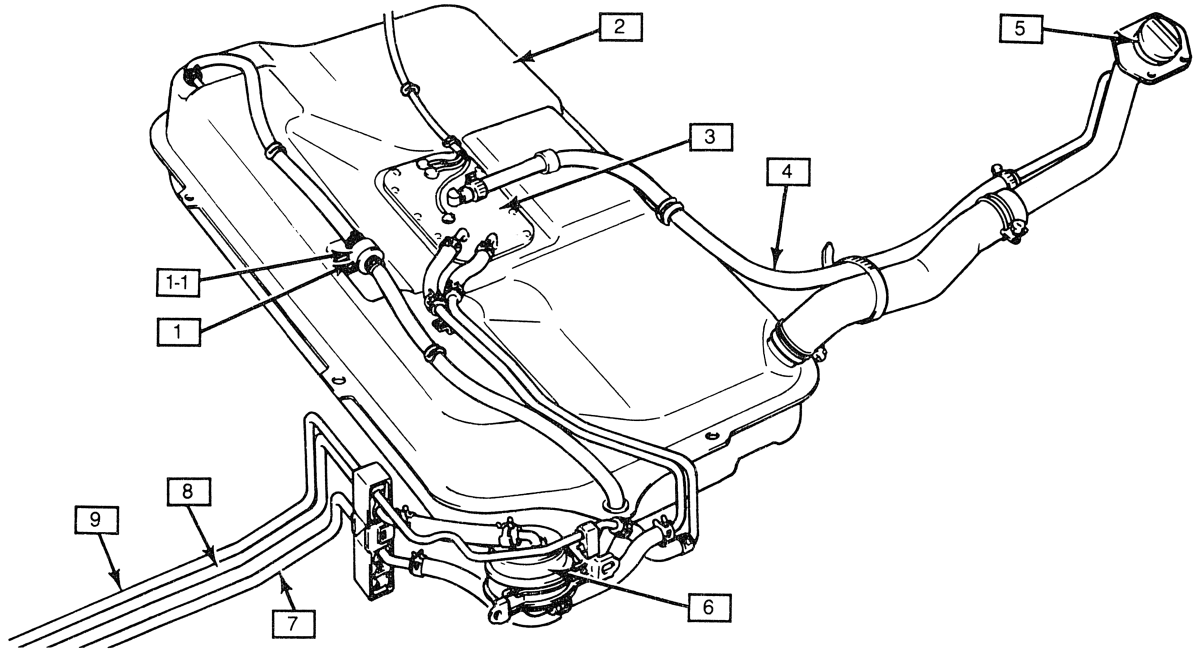
The vapor storage canister is used to control the emission of fuel vapors from the fuel system. For further information regarding vehicle emission control system operation, refer to DRIVEABILITY AND EMISSIONS (Section 6E).

FUEL FILTER

CAUTION: To reduce the risk of fire and personal injury, it is necessary to relieve the fuel system pressure before servicing fuel system components. For information on this procedure, refer to "Fuel System Pressure Relief" in this section.

The fuel filter is located in front of the fuel tank as shown in. The filter is incorporated into the fuel feed line and is used to filter engine fuel before it reaches the throttle body injection unit.

The fuel filter is not a serviceable component, and must be replaced as an assembly (Figure 3).



1 2-WAY CHECK VALVE
1-1 BLACK SIDE
2 FUEL TANK
3 FUEL PUMP AND SENDING UNIT
4 BREATHER HOSE
5 FUEL FILLER CAP
6 FUEL FILTER
7 FUEL VAPOR LINE
8 FUEL FEED LINE
9 FUEL RETURN LINE

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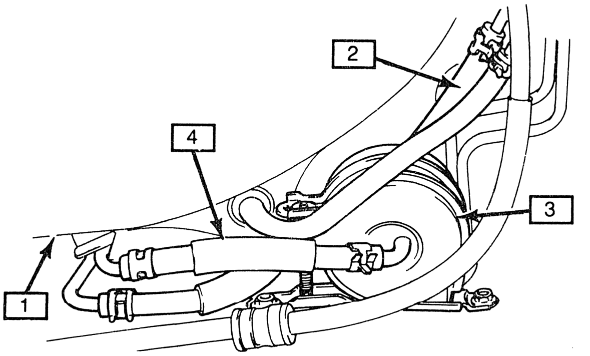
Figure 2 Fuel System



1 FUEL TANK
2 OUTLET HOSE
3 FUEL FILTER
4 INLET HOSE

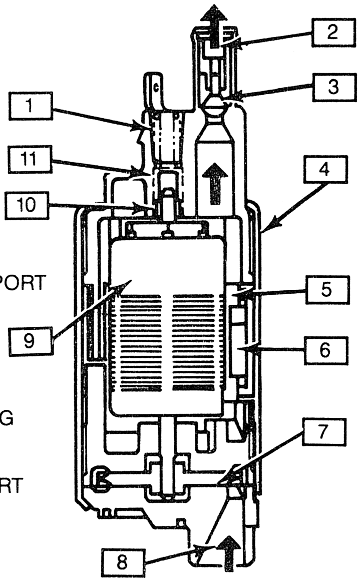
LC0001-6C-M-RS

Figure 3 Fuel Filter Location

FUEL PUMP

CAUTION: To reduce the risk of fire and personal injury, it is necessary to relieve the fuel system pressure before servicing fuel system components. Refer to "Fuel Pump Relay Replacement" procedure in this section.

The electric fuel pump is located in the fuel tank. Pump operation is controlled through the fuel pump relay and engine control module (ECM) (Figure 4). For additional information on this system, refer to DRIVEABILITY AND EMISSIONS (Section 6E).



1 BRUSH SPRING
2 FUEL OUTLET PORT
3 CHECK VALVE
4 HOUSING
5 MAGNET
6 MAGNET SPRING
7 IMPELLER
8 FUEL INLET PORT
9 ARMATURE
10 BEARING
11 BRUSH

KC0826-6C-M-RS

Figure 4 Fuel Pump Cross Section

When the fuel pump is on operation, an impeller turns with the motor in the pump assembly. This causes fuel within the tank to be drawn into the fuel pump inlet port. Fuel is discharged under pressure through the pump outlet to the fuel feed line. Located in the fuel pump is a check valve to hold fuel pressure within the fuel feed line when the vehicle is not in operation (Figure 4).

Inspect

1. If the fuel pump is suspected of delivering an improper amount of fuel, it should be inspected and tested in the vehicle as follows:

- Make certain that there is sufficient fuel in the tank.
- With the engine running, inspect for leaks at all fuel feed linesand hose connections from the fuel tank to the throttle body unit. Tighten any loose connections and inspect all hoses for flattening or kinks which would restrict the flow of fuel.
- If fuel pump is determined to be faulty, refer to DRIVEABILITY AND EMISSIONS (Section 6E) for further fuel system diagnostics.

FUEL TANK

The fuel tank is located under the rear of the vehicle. The fuel pump and sending unit are installed in the upper part of the tank. The tank must be removed to service the fuel pump and/or sending unit (Figures 2 and 5).

The fuel tank and lines should be inspected for road damage which could cause leakage. Inspect fuel cap for correct sealing and indications of malfunctioning parts.

Before attempting service of any type on the fuel tank, always:

1. Remove negative battery cable.
2. Place "no smoking" signs near work area.
3. Be sure to have a fire extinguisher (Class B) close at hand.
4. Wear safety glasses.
5. Siphon or pump fuel into an approved fuel handling container.

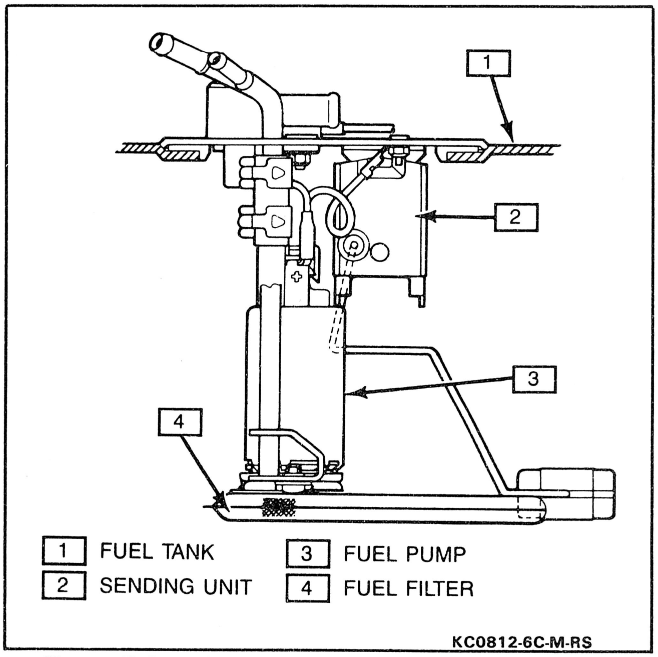


Figure 5 Fuel Pump and Sending Unit Mounting

FUEL TANK FILLER NECK

To help prevent refueling with leaded gasoline, the fuel filler neck of this vehicle has a built-in restrictor and deflector. The opening in the restrictor only admits the smaller gas nozzle spout, which must be fully inserted to bypass the deflector. Attemped refueling with a leaded gas nozzle will result in gasoline splashing back out of the filler neck.

FUEL FILLER CAP

The fuel filler cap used on this vehicle is of the pressure-vacuum type. A ratchet tightening device on the threaded portion of the fuel filler cap reduces the chances of incorrect installation, which would prevent sealing of the fuel vapors (Figure 6).

After the gasket on the fuel filler cap and the filler neck flange contact, the rachet produces a loud "clicking" sound, indicating the seal has been set.

A vacuum relief valve is incorporated into the fuel filler cap. If the pressure in the fuel tank becomes negative (vacuum), the relief valve opens to release the pressure created within the fuel tank. Only when vacuum becomes excessive within the tank does this occur. Normally, vacuum pressure is relieved by the 2-way check valve which is located in the fuel vapor line, mounted on the front of the fuel tank (Figure 2).

A pressure relief valve is also located in the fuel filler cap. If the pressure of fuel vapor within the tank should exceed that for which the fuel system is designed, the pressure relief valve opens, and excess pressure is vented to the atmosphere.

CAUTION: If the pressure in the fuel tank is not released prior to system service, the fuel in the tank may be forced out through the fuel hoses or lines due to this pressure during disconnection.

NOTICE: To release the fuel vapor pressure in the fuel tank, remove the fuel filler cap and then reinstall it.

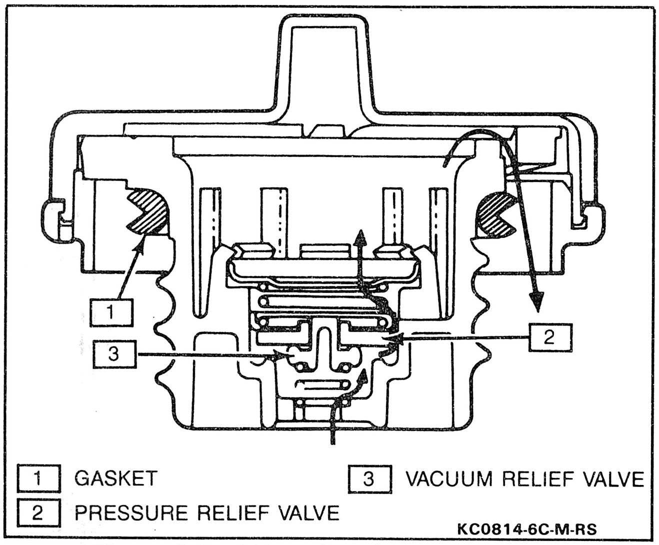


Figure 6 Fuel Filler Cap Cross Section

ON-VEHICLE SERVICE

FUEL FILTER

Figures 7 and 8

Remove or Disconnect

1. Relieve fuel system pressure. Refer to "Fuel System Pressure Relief" in this section.
2. Fuel filler cap from fuel filler neck to release fuel vapor pressure in fuel tank. Reinstall cap.

   CAUTION: If the pressure in the fuel tank is not released prior to system service, the fuel in the tank may be forced out through the fuel hoses due to this pressure during disconnection.
3. Negative battery cable.
4. Hoist vehicle.
5. Place appropriate fuel holding container under fuel filter.
6. Fuel filter inlet hose clamp and hose from the filter.

   CAUTION: A small amount of fuel may be released after the fuel hose is disconnected. In order to reduce the chance of personal injury, cover the fitting to be disconnected with a shop cloth.
7. Fuel filter outlet hose clamp and hose from the fuel feed line.
8. Fuel filter, mounting bracket, and outlet hose as an assembly from the vehicle.
9. Fuel filter outlet hose clamp and hose from the filter.
10. Mounting bracket from the filter.

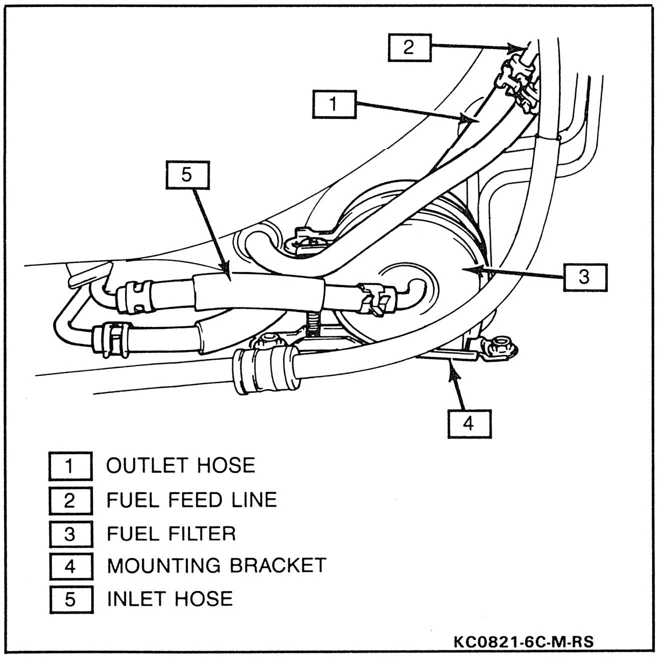


Figure 7 Fuel Filler Removal

Install or Connect

1. Mounting bracket to fuel filter.

NOTICE: Be sure to align match marks on fuel filter and bracket before tightening bracket bolt.

2. Fuel filter outlet hose and clamp to filter outlet port.
3. Fuel filter, mounting bracket, and outlet hose as an assembly to the vehicle.
4. Fuel filter outlet hose and clamp to the fuel feed line.
5. Fuel filter inlet hose and clamp to the filter.
6. Negative battery cable.
7. Verify that there is no fuel leakage at each connection. Refer to "Fuel Leakage Check" in this section.

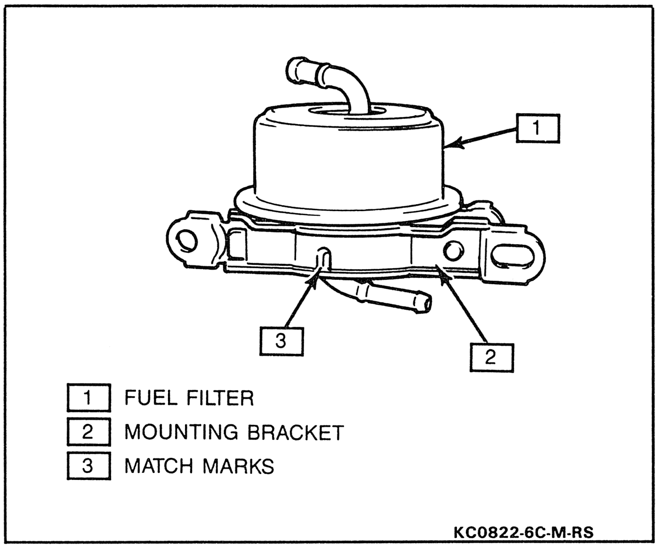


Figure 8 Fuel Filter Installation

FUEL PUMP AND SENDING UNIT

Figure 9

Remove or Disconnect

1. Fuel tank from the vehicle. Refer to "Fuel Tank Removal" in this section.
2. Rear seat cushion. Refer to SEATS (Section 10-9).
3. Fuel feed and return clamps and hoses from the fuel pump assembly.
4. Twelve attaching screws from the fuel pump assembly and the assembly with gasket from the fuel tank.
5. One mounting screw from the fuel pump motor assembly.
6. Disconnect two fuel pump motor electrical connectors and remove the pump motor from the fuel pump assembly.
7. Two mounting screws from the sending unit.
8. Disconnect two sending unit lead wires from the fuel pump assembly and remove the unit.

Inspect

- Fuel pump filter (sock) for evidence of dirt and contamination. If present, clean and check for presence of dirt in fuel tank.

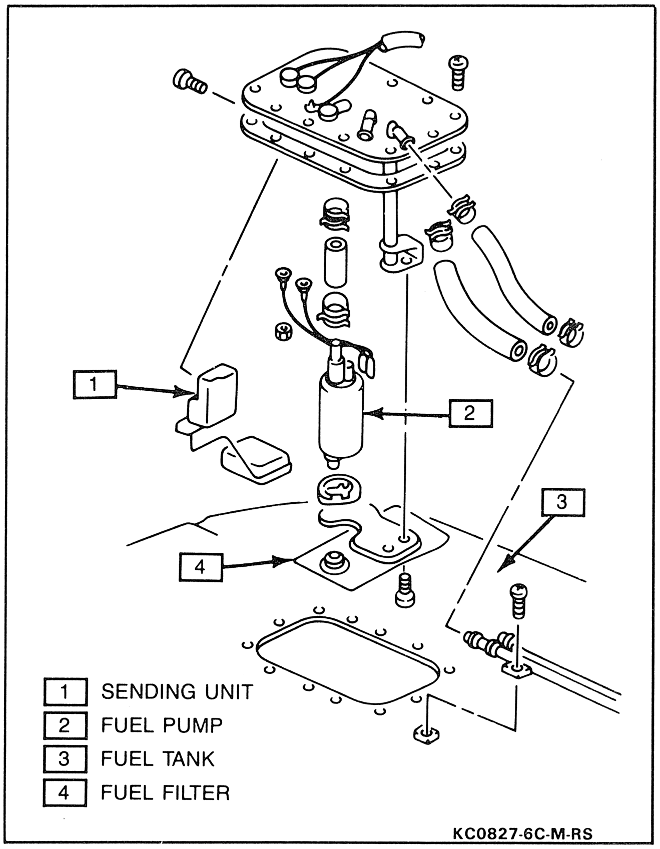


Figure 9 Fuel Pump and Sending Unit Removal

Install or Connect

1. Sending unit and lead wires to the fuel pump assembly.
2. Two mounting screws to the sending unit.
3. Fuel pump motor to fuel pump assembly, and connect two pump motor electrical connectors.
4. One mounting screw to the fuel pump motor.
5. Fuel pump assembly and gasket to the fuel tank.
6. Twelve attaching screws to the fuel pump assembly.
7. Fuel feed and return hoses and clamps to the fuel pump assembly.
8. Fuel tank to the vehicle. Refer to "Fuel Tank Installation" in this section.

FUEL TANK

CAUTION: To help avoid personal injury when vehicle is onno a hoist, provide additional support for the vehicle on the opposite end from which components are being removed. This will reduce the possibility of the vehicle falling off the hoist.

Draining Fuel Tank

Figures 10, 11, and 12

1. Disconnect negative battery cable. Also, have a fire extinguisher (Class B) near work area.
2. Remove fuel filler cap.
3. Use a hand-operated pump device when possible to drain as much fuel through the filler neck hose as possible.
4. If a hand operated pump device cannot be used to complete the draining process, use a siphon at the fuel filler neck hose.

   CAUTION: Never drain or store gasoline in an open container due to the possibility of fire or explosion.
5. Reinstall removed fuel filler neck hose, fuel filler cap, and negative battery cable.

Install or Connect

1. Relieve fuel system pressure. Refer to "Fuel System Pressure Relief" in this section.
2. Fuel filler cap from fuel filler neck to release fuel vapor pressure in fuel tank. Reinstall cap.

   CAUTION: If the pressure in the fuel tank is not released prior to system service, the fuel in the tank may be forced out through the fuel hoses due to this pressure during disconnection.
3. Negative battery cable.
4. Rear seat cushion from vehicle. Refer to SEATS (Section 10-9).
5. Disconnect fuel pump motor and sending unity electrical connectors and detach wire tape (Figure 10).
6. Wire harness grommet and harness through the vehicle floor pan (Figure 10).

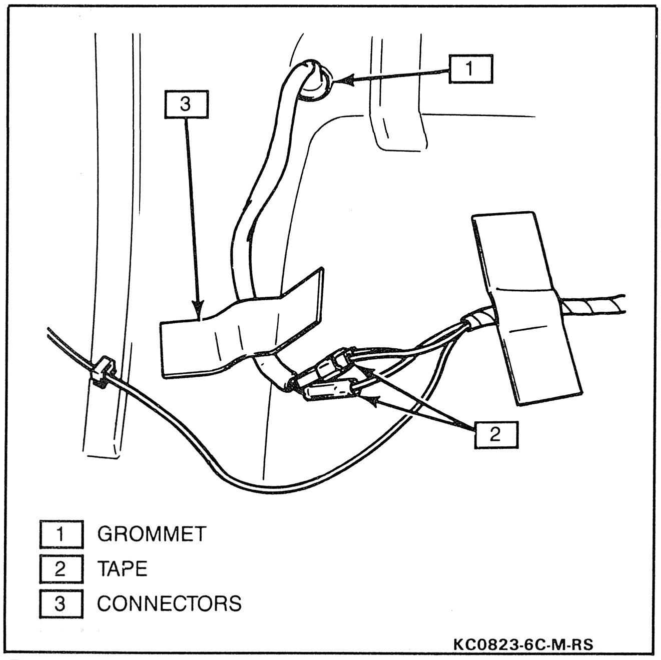


Figure 10 Fuel Pump Motor and Sending Unit Electrical Connectors

7. Hoist vehicle.
8. Fuel filler hose clamp and hose from the filler neck assembly (Figure 11).
9. Fuel breather hose clamp and hose from the filler neck assembly (Figure 11).

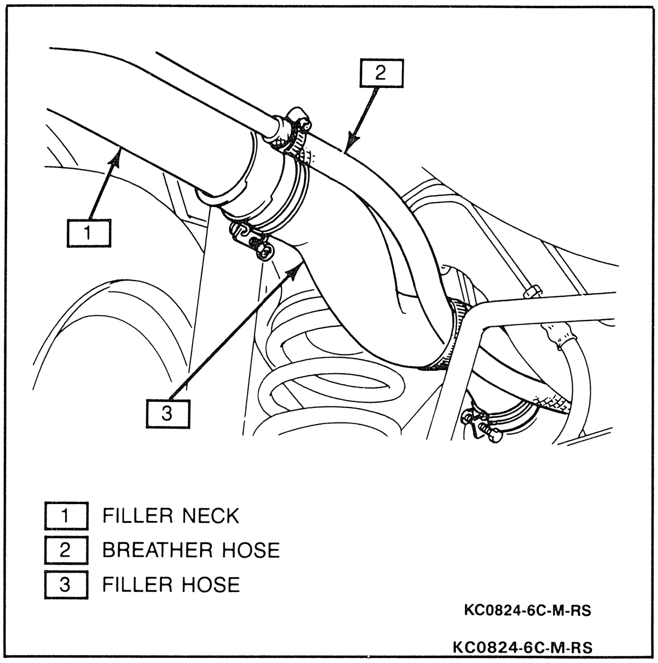


Figure 11 Fuel Filler Neck Hose and Breather Hose Removal and Installation

10. Drain fuel tank. Refer to "Draining Fuel Tank" in this section.
11. Fuel filter inlet hose clamp and hose from filter (Figure 12).

CAUTION: A small amount of fuel may be released after the fuel hose is disconnected. In order to reduce the chance of personal injury, cover the fitting to be disconnected with a shop cloth.

12. Fuel vapor hose clamp and hose, and fuel return hose clamp and hose from respective fuel lines (Figure 12).
13. Five fuel tank mounting bolts and the fuel tank from the vehicle.

Inspect

- After removing the fuel tank, check hoses and lines connected to the tank for signs of leaks, loose connections, deterioration, or damage.
- Check fuel pump assembly gasket for signs of leaks.
- Visually inspect fuel tank for signs of leaks and damage. Replace any damaged, worn, or malfunctioning parts.

Fuel Tank Purging Procedure

Figures 1, 2, 10, 11, and 12

The following procedure is used prior to repairing the fuel tank.

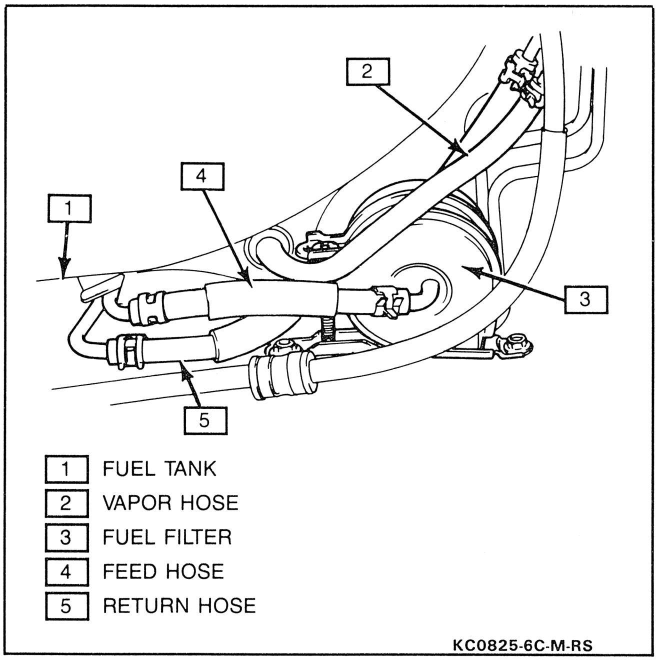


Figure 12 Fuel Filter Inlet Hose, Fuel Vapor Hose, and Fuel Return Hose Removal and Installation

CAUTION: This procedure will not remove all fuel vapor. Do not attempt any repair on fuel tank where heat or flame is required, as fire or explosion could occur resulting in personal injury.

1. Remove all hoses, fuel pump and sending unit (See procedure in this section), and 2-way check valve from the fuel tank and drain any remaining fuel from the tank.
2. Visually inspect interior cavity of tank.
3. Move tank to flushing area (wash rack).
4. Fill tank completely with tap water, agitate vigorously, and drain.
5. Completely flush out remaining water after washing.

NOTICE: If inside of fuel tank is found to contain rust after cleaning, it must be replaced.

Remove or Disconnect

1. Fuel pump and sending unit to fuel tank. Refer to "Fuel Pump and Sending Unit" in this section.
2. 2-way check valve to fuel tank.

NOTICE: The black nozzle side of the check valve should be installed toward the fuel tank (Figure 2).

3. All fuel hoses, lines, and fuel breather hose to the fuel tank (Figure 2).

NOTICE: Be sure to clamp all hoses and lines securely (Figure 1).

4. Fuel tank to vehicle and five fuel tank mounting bolts to the fuel tank.

5. Fuel breather hose and hose clamp to the filler neck assembly (Figure 11).
7. Fuel vapor hose and hose clamp, and fuel return hose and hose clamp to respective fuel lines (Figure 12).
8. Fuel filter inlet hose and hose clamp to filter (Figure 12)

NOTICE: Be sure to clamp all hoses and lines securely (Figure 1).

9. Lower vehicle.
10. Wire harness and grommet through the vehicle floor pan (Figure 10).
11. Connect fuel pump motor and sending unit electrical connectors and attach wire tape (Figure 10).
12. Rear seat cushion vehicle. Refer to SEATS (Section 10-9).
13. Negative battery cable.

Inspect

- Fuel system for leakage. Refer to "Fuel Leakage Check" in this section.

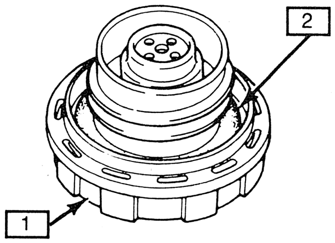
FUEL FILLER CAP

Inspect

1. Remove fuel filler cap from filler neck and check gasket for even filler neck imprint, and deterioration. If any damage is evident, or cap is malfunctioning, replace cap.

Important

- If cap requires replacement, only a cap with the same features should be used. Failure to use the correct cap can result in serious malfunction and/or damage to the evaporative emission control system. For further information on this system, refer to DRIVEABILITY AND EMISSIONS (Section 6E).



1 FUEL FILLER CAP
2 GASKET

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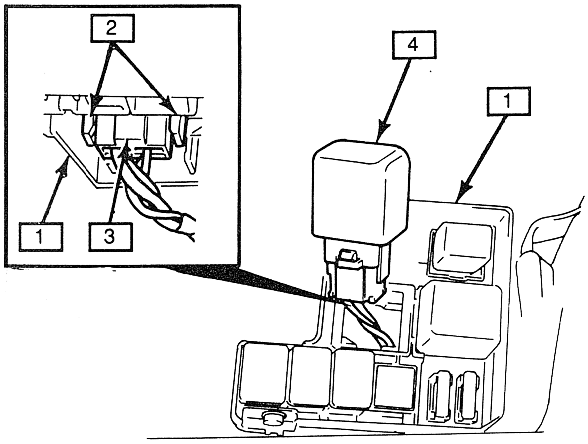
Figure 13 Fuel Filler Cap Inspection

FUEL PUMP RELAY

Figure 14

Remove or Disconnect

1. Negative battery cable.
2. Main fusebox cover and engine coolant reservoir from mounting bracket. Refer to ENGINE COOLING (Section 6B).
3. Two main fusebox mounting screws from the fusebox.
4. Carefully release two lock tabs of the relay and remove relay and connector as an assembly from the fusebox (Figure 14).
5. Electrical connector from relay and remove relay from vehicle (Figure 14).



1 MAIN FUSE BOX
2 LOCK TABS
3 FUEL PUMP RELAY ELECTRICAL CONNECTOR
4 FUEL PUMP RELAY

KC0828-6C-M-RS

Figure 14 Fuel Pump Relay Removal

Install or Connect

1. Electrical connector to fuel pump relay.
2. Fuel pump relay and connector as an assembly to the main fusebox.
3. Two main fusebox mounting screws to fusebox.
4. Engine coolant reservoir to mounting bracket and main fusebox cover to fusebox. Refer to ENGINE COOLING (Section 6B).
5. Negative battery cable.
6. Verify proper fuel pump operation.

ACCELERATOR CABLE

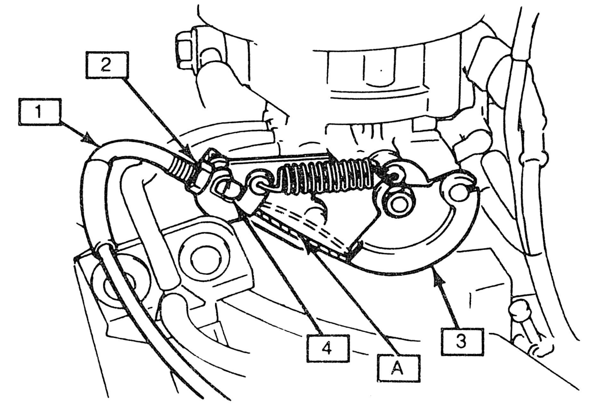
Figure 15

Adjust

1. Accelerator cable for end play.
2. Cable end play should be within specification when accelerator pedal is released and engine is not operating.

- Accelerator cable end play specification: 0.0 mm (0.0 in.).

3. If not within specification, adjust by loosening lock nut. Be sure to tighten nut securely after adjustment is made.



A CABLE END PLAY
1 ACCELERATOR CABLE
2 LOCK NUT
3 THROTTLE LEVER
4 ADJUSTING NUT

Figure 15 Accelerator Cable End Play

FUEL LINES

Figures 16, 17, 18, 19

Due to the fact that the fuel pipes are under high pressure, these fuel system components require special consideration for service.

CAUTION: To reduce the risk of fire and personal injury, it is necessary to relieve the fuel system pressure before servicing fuel system components. See fuel system pressure relief procedure in this section.

Inspect

- Visually, the fuel lines for evidence of fuel leakage, hose cracking, and deterioration or damage. Check that all clamps and fittings are secure. Repair and/or replace parts as necessary.

Remove or Disconnect

1. Relieve fuel system pressure. Refer to "Fuel System Pressure Relief" in this section.
2. Fuel filler cap from fuel filler neck to release fuel vapor pressure in fuel tank. Reinstall cap.

   CAUTION: If the pressure in the fuel tank is not released prior to system service, the fuel in the tank may be forced out through the fuel hoses due to this pressure during disconnection.

3. Negative battery cable.
4. Hoist vehicle.

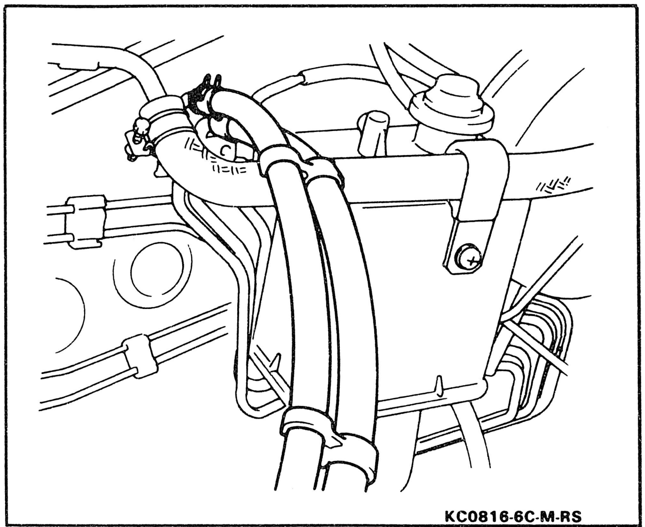


Figure 16 Fuel Lines Inspection

5. Brake pipe from four-way joint and at brake proportioning valve. Refer to BRAKES (Section 5).
6. Fuel filter outlet hose clamp and hose from the fuel feed line.
7. Fuel return hose clmap and hose from the fuel return line.
8. Fuel vapor hose clamp and hose from the fuel vapor line.
9. Fuel feed, return, and vapor hose clamps and hoses from respective lines at the front of the vehicle.

   CAUTION: A small amount of fuel may be released after the fuel hose is disconnected. In order to reduce the chance of personal injury, cover the fitting to be disconnected with a shop cloth.

10. Three line guards from the vehicle chassis.

    NOTICE: There are two mounting nuts for each of the line guards.

11. Place a position mark on vehicle chassis and each line so that clamps can be installed on the same position (Figure 17).
12. Line clamps and lines as an assembly from the vehicle.
13. Clamps from lines (Figure 18).

Install or Connect

1. Line clamps to marked positions on lines.

   NOTICE: If line clamp is deformed or its claw is bent or broken, replace clamp with a new one.

2. Line clamps and lines as an assembly to the vehicle (Figure 19).
3. Three line guards to the vehicle chassis.

   NOTICE: Use new mounting nuts for each of the line guards.

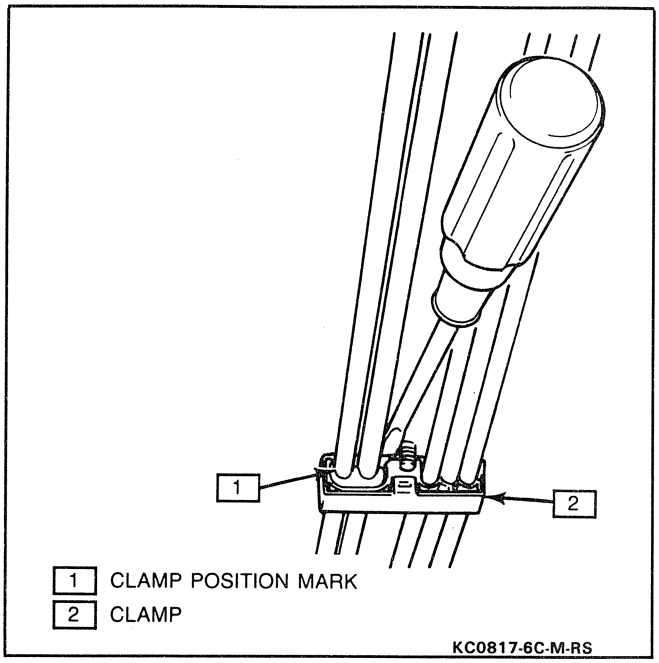

1
2
1 CLAMP POSITION MARK
2 CLAMP
KC0817-6C-M-RS

Figure 17 Line Clamp and Line Removal

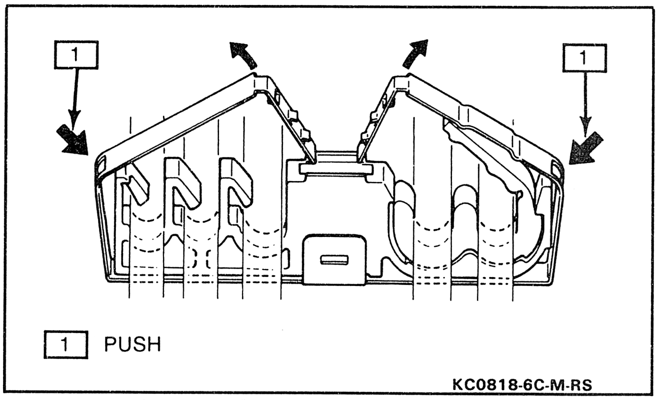

1
1
1 PUSH
KC0818-6C-M-RS

Figure 18 Line Clamp Removal

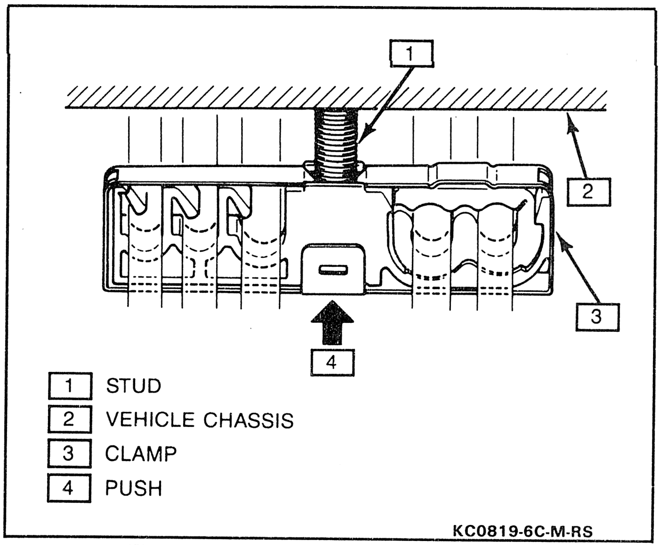

1
2
3
4
1 STUD
2 VEHICLE CHASSIS
3 CLAMP
4 PUSH
KC0819-6C-M-RS

Figure 19 Line Clamp Installation

4. Fuel feed, return and vapor hoses and hose clamps to respective lines at the front of vehicle.
5. Fuel vapor hose and hose clamp to the fuel vapor line.
6. Fuel return hose and hose clamp to the fuel return line.
7. Fuel filter outlet hose and hose clamp to the fuel feed line.
8. Brake pipe to four-way joint and to brake proportioning valve. Refer to BRAKES (Section 5).
9. Negative battery cable.
10. Check fuel lines for leakage. Refer to "Fuel Leakage Check" procedure in this section.
11. Bleed brake system as necessary. Refer to BRAKES (Section 5).

SECTION 6D

ENGINE ELECTRICAL

CONTENTS

GENERAL INFORMATION 6D-1
- Battery 6D1-1
- Cranking System 6D2-1
- Charging System 6D3-1
- Ignition System 6D4-1
- Engine Wiring 6D5-1
- General Electrical System Diagnosis 6D-1

GENERAL INFORMATION

6D1 - BATTERY

This section contains information on the maintenance, diagnosis, storing, charging, and jump starting of batteries.

6D2 - CRANKING SYSTEM

This section contains the diagnosis, servicing, and specifications of the cranking circuit and starter motor.

6D3 - CHARGING SYSTEM

This section contains generator diagnosis, servicing, and specifications.

6D4 - IGNITION SYSTEM

This section contains the information required to service all ignition system components. These components include the distributor, ignition switch, spark plugs, and the ignition primary and secondary wiring.

6D5 - ENGINE WIRING

This section contains engine wiring views.

GENERAL ELECTRICAL SYSTEM DIAGNOSIS

The following two diagnostic charts are intended for general electrical system diagnosis. More specific diagnosis and repair procedures for electrical subsystems are located in the following subsections (Figures 1 and 2):

- 6D1 - Battery
- 6D2 - Cranking Systems
- 6D3 - Charging Systems
- 6D4 - Ignition Systems

Where a "driveability" complaint exists, or an ECM code is set, refer to Section 6E.

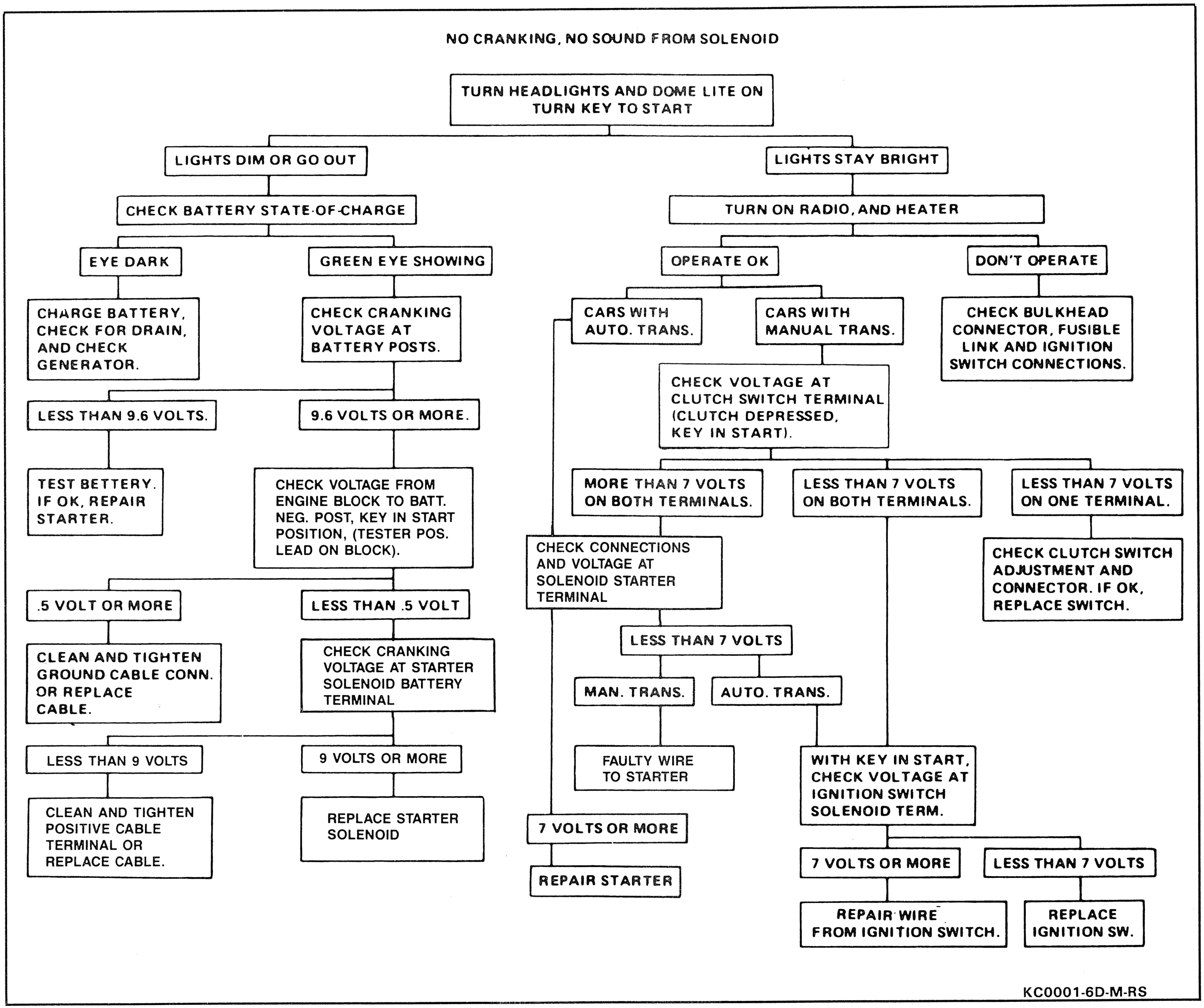
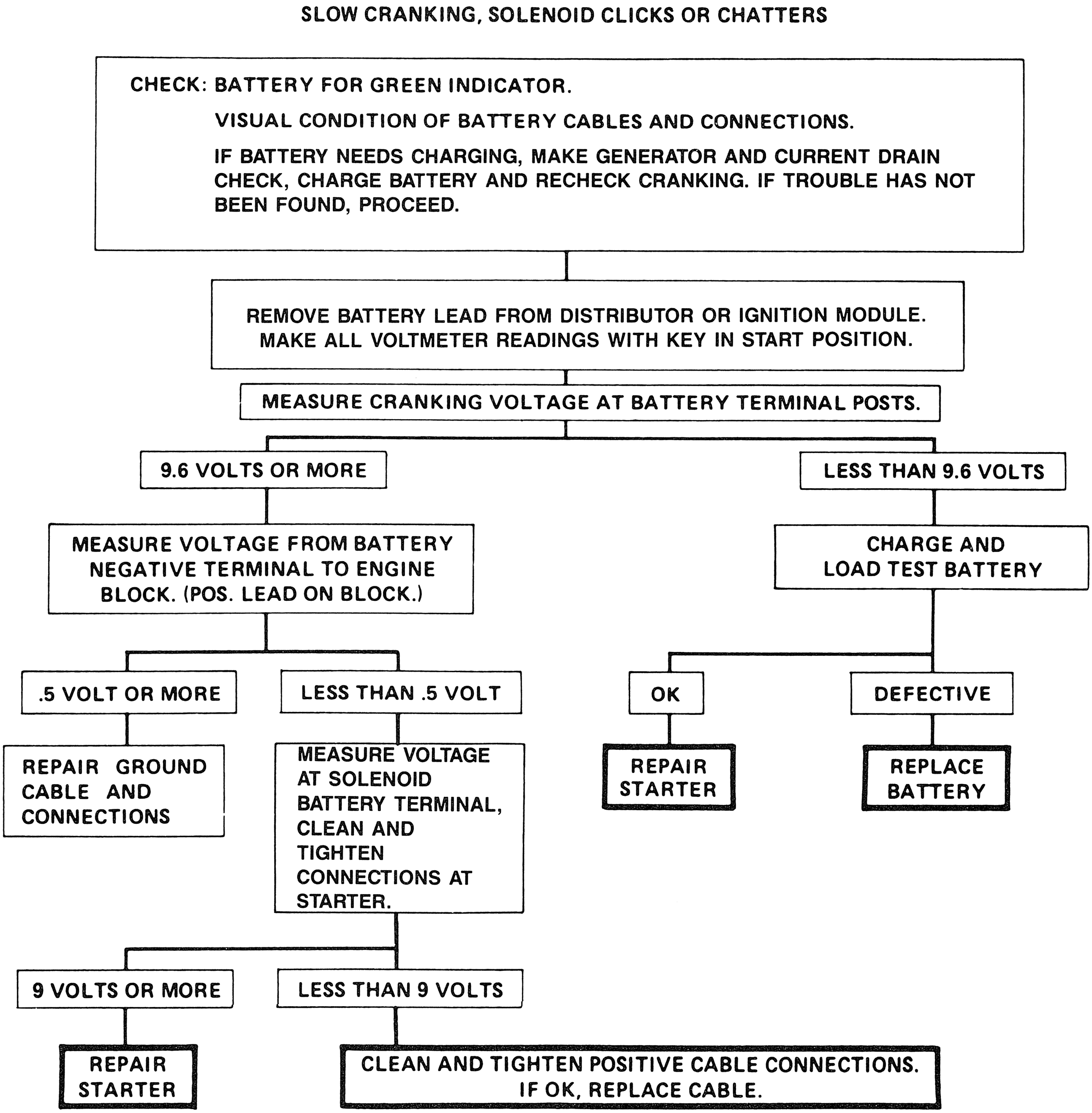

NO CRANKING, NO SOUND FROM SOLENOID
TURN HEADLIGHTS AND DOME LITE ON TURN KEY TO START
LIGHTS DIM OR GO OUT
LIGHTS STAY BRIGHT
CHECK BATTERY STATE-OF-CHARGE
TURN ON RADIO, AND HEATER
EYE DARK
GREEN EYE SHOWING
OPERATE OK
DON'T OPERATE
CHARGE BATTERY, CHECK FOR DRAIN, AND CHECK GENERATOR.
CHECK CRANKING VOLTAGE AT BATTERY POSTS.
CARS WITH AUTO. TRANS.
CARS WITH MANUAL TRANS.
CHECK BULKHEAD CONNECTOR, FUSIBLE LINK AND IGNITION SWITCH CONNECTIONS.
CHECK VOLTAGE AT CLUTCH SWITCH TERMINAL (CLUTCH DEPRESSED, KEY IN START).
LESS THAN 9.6 VOLTS.
9.6 VOLTS OR MORE.
TEST BETTERY. IF OK, REPAIR STARTER.
CHECK VOLTAGE FROM ENGINE BLOCK TO BATT. NEG. POST, KEY IN START POSITION, (TESTER POS. LEAD ON BLOCK).
MORE THAN 7 VOLTS ON BOTH TERMINALS.
LESS THAN 7 VOLTS ON BOTH TERMINALS.
LESS THAN 7 VOLTS ON ONE TERMINAL.
CHECK CONNECTIONS AND VOLTAGE AT SOLENOID STARTER TERMINAL
CHECK CLUTCH SWITCH ADJUSTMENT AND CONNECTOR. IF OK, REPLACE SWITCH.
.5 VOLT OR MORE
LESS THAN .5 VOLT
LESS THAN 7 VOLTS
CLEAN AND TIGHTEN GROUND CABLE CONN. OR REPLACE CABLE.
CHECK CRANKING VOLTAGE AT STARTER SOLENOID BATTERY TERMINAL
MAN. TRANS.
AUTO. TRANS.
LESS THAN 9 VOLTS
9 VOLTS OR MORE
FAULTY WIRE TO STARTER
WITH KEY IN START, CHECK VOLTAGE AT IGNITION SWITCH SOLENOID TERM.
CLEAN AND TIGHTEN POSITIVE CABLE TERMINAL OR REPLACE CABLE.
REPLACE STARTER SOLENOID
7 VOLTS OR MORE
REPAIR STARTER
7 VOLTS OR MORE
LESS THAN 7 VOLTS
REPAIR WIRE FROM IGNITION SWITCH.
REPLACE IGNITION SW.
KC0001-6D-M-RS

Figure 1 Electrical System General Diagnosis - 1 of 2


SLOW CRANKING, SOLENOID CLICKS OR CHATTERS
CHECK: BATTERY FOR GREEN INDICATOR.
VISUAL CONDITION OF BATTERY CABLES AND CONNECTIONS.
IF BATTERY NEEDS CHARGING, MAKE GENERATOR AND CURRENT DRAIN CHECK, CHARGE BATTERY AND RECHECK CRANKING. IF TROUBLE HAS NOT BEEN FOUND, PROCEED.
REMOVE BATTERY LEAD FROM DISTRIBUTOR OR IGNITION MODULE. MAKE ALL VOLTMETER READINGS WITH KEY IN START POSITION.
MEASURE CRANKING VOLTAGE AT BATTERY TERMINAL POSTS.
9.6 VOLTS OR MORE
LESS THAN 9.6 VOLTS
MEASURE VOLTAGE FROM BATTERY NEGATIVE TERMINAL TO ENGINE BLOCK. (POS. LEAD ON BLOCK.)
CHARGE AND LOAD TEST BATTERY
.5 VOLT OR MORE
LESS THAN .5 VOLT
OK
DEFECTIVE
REPAIR GROUND CABLE AND CONNECTIONS
MEASURE VOLTAGE AT SOLENOID BATTERY TERMINAL, CLEAN AND TIGHTEN CONNECTIONS AT STARTER.
REPAIR STARTER
REPLACE BATTERY
9 VOLTS OR MORE
LESS THAN 9 VOLTS
REPAIR STARTER
CLEAN AND TIGHTEN POSITIVE CABLE CONNECTIONS. IF OK, REPLACE CABLE.

THIS PROCEDURE IS DESIGNED FOR USE ON ENGINES AND BATTERIES AT ROOM OR NORMAL OPERATING TEMPERATURES. IT ALSO ASSUMES THERE ARE NO ENGINE DEFECTS WHICH WOULD CAUSE CRANKING PROBLEMS. TO USE IT UNDER OTHER CONDITIONS MIGHT RESULT IN MISDIAGNOSIS.

KC0002-6D-M-RS

Figure 2 Electrical System General Diagnosis - 2 of 2

SECTION 6D1

BATTERY

CONTENTS

GENERAL DESCRIPTION 6D1-1
BATTERY RATINGS 6D1-1
  Reserve Capacity 6D1-1
  Cold Cranking Amperage 6D1-1
COMMON CAUSES OF FAILURE 6D1-2
ELECTROLYTE FREEZING 6D1-2
BUILT-IN HYDROMETER 6D1-2
BATTERY RETAINER 6D1-2
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  Charging a Completely Discharged
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  Battery Cable Replacement 6D1-5
  Negative Battery Cable 6D1-5
  Positive Battery Cable 6D1-5
BATTERY USAGE CHART 6D1-6
TORQUE SPECIFICATIONS 6D1-6
SPECIAL TOOLS 6D1-6

CAUTION: All batteries generate hydrogen gas which is extremely flammable. If ignited by a spark or flame, this gas may explode violently, causing spraying of acid, fragmentation of the battery, and possible servere personal injuries. Wear approved eye protection. Battery fluid is corrosive acid. Flush any contacted area with water immediately and thoroughly.

GENERAL DESCRIPTION

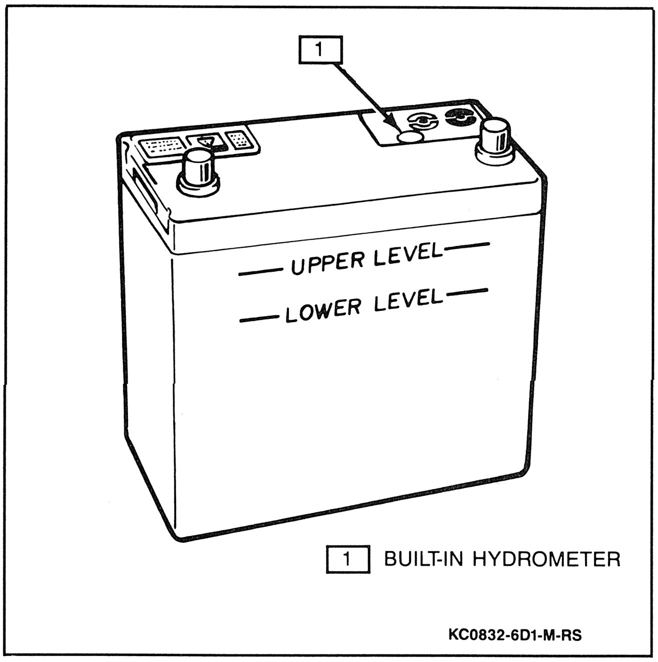

Figure 1 Battery

The sealed battery is standard on all vehicles. There are no vent plugs in the cover. The battery is completely sealed except for small vent holes. These vent holes allow the small amount of gas produced in the battery to escape.

The battery has three major functions in the electrical system: first, it provides a source of energy for cranking the engine; second, it acts as a voltage stabilizer for the electrical system; and third, it provides electrical energy for a limited time when electrical load exceeds generator output.

The battery specification label contains information important to the servicing of the battery. This information includes test ratings and original equipment replacement part numbers.

BATTERY RATINGS

A battery has two ratings: (1) a reserve capacity rating at 27°C (80°F) which is the time that a fully charged battery will operate the vehicle with no generator operation; and (2) a cold rating at -18°C (0°F) which indicates the battery's cranking load capacity.

RESERVE CAPACITY

Reserve Capacity is the length of time (expressed in minutes) required for a fully charged battery to discharge to a terminal voltage of 10.5 volts. All batteries are rated at a constant temperature of 27°C (80°F) and a constant current drain of 25 amperes. This current drain is about the same as operating a vehicle with the headlights ON, other minimal electrical loading, and no generator output.

COLD CRANKING AMPERAGE

The Cold Cranking Amperage rating is the minimum amperage which must be maintained by the battery for 30 seconds while meeting a minimum voltage requirement of 7.2 volts. All batteries are tested at -18°C (0°F). This rating is a measure of the battery's cold cranking capacity.

COMMON CAUSES OF FAILURE

The battery is not designed to last indefinitely; however, with proper care, it will provide many years of service.

If the battery tests good, but fails to perform satisfactorily in service for no apparent reason, the following are some of the more important factors that may be the cause of the problem:

1. Vehicle accessories left ON overnight.
2. Slow average driving speeds for short periods.
3. Electrical load is greater than generator output. (This can happen if aftermarket electrical accessories are added without regard to generator output.)
4. Conditions in the charging system such as electrical shorts, slipping fan belt, faulty generator, or voltage regulator.
5. Battery abuse - such as failure to maintain clean and tight battery connections or a loose battery retainer which allows the battery to slide around.
6. Extended vehicle storage.
7. Batteries being less than adequately charged when received.
8. Extended engine cranking due to mechanical engine conditions.
9. Incorrect interpretation of the charge indicator.
10. Inability to determine the correct ampere-hour charging rate for a discharged battery.
11. Continued current draw on battery through increased parasitic drain.

ELECTROLYTE FREEZING

The freezing point of electrolyte depends on its specific gravity. Since specific gravity depends on the state of charge, the battery should be protected against freezing by keeping it in a charged condition.

BUILT-IN HYDROMETER

A built-in temperature-compensated hydrometer is incorporated into the top of the sealed battery. When observing the hydrometer, make sure that the battery has a clean top. A light may be required in poorly lit areas.

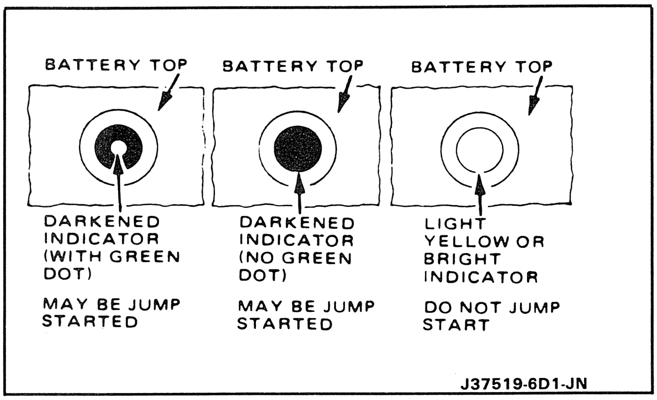

Figure 2 Built-In Hydrometer Indications

Three hydrometer indications can be observed (Figure 2):

1. GREEN DOT VISIBLE

   The battery is ready for testing.

2. DARK (DOT NOT VISIBLE)

   If there is a cranking complaint, the battery should be tested as described in the Diagnosis section. The charging and electrical systems should also be checked at this time.

3. CLEAR OR LIGHT YELLOW

   The battery fluid level has fallen below the bottom of the hydrometer. This can be caused by excessive or prolonged charging, a broken case, excessive tipping, or normal battery deterioration. When a battery is discovered in this condition and no leakage is evident, a faulty charging system that is overcharging the battery should be suspected. Therefore, the charging and electrical systems should both be checked thoroughly. If there is a cranking complaint, replace the battery.

BATTERY RETAINER

The battery retainer should be clean and free from corrision before installing the battery. The retainer nuts should be tightened securely but not so tight that the upper retainer bracket is deformed. All retainer components should be in sound condition so that the battery will be held in a level position.

DIAGNOSIS

The following procedure should be used for testing batteries:

1. VISUAL INSPECTION

   Check for obvious damage such as a cracked or broken case that would permit electrolyte loss. If damage is noted, replace the battery, determine the cause of damage, and correct as required.

2. HYDROMETER CHECK
   - a. GREEN DOT VISIBLE - Go to Step 3.
   - b. DARK (DOT NOT VISIBLE) - Charge the battery as outlined under "Charging Procedure" in this section and proceed to Step 3.

3. LOAD TEST
   - a. Connect a voltmeter and a battery load tester across the battery terminals.
   - b. Apply a 300 ampere load for 15 seconds to remove the surface charge from the battery. Remove the load.
   - c. Wait 15 seconds to let the battery recover. Apply the specified load located on the battery label or in the "Battery Usage Chart" at the end of this section. Read the voltage after 15 seconds and remove the load.
   - d. If the voltage does not drop below the minimum, the battery is good and should be

BATTERY LOAD TEST VOLTAGE	
ESTIMATED TEMPERATURE	MINIMUM VOLTAGE
21°C (70°F)	9.6
10°C (50°F)	9.4
0°C (30°F)	9.1
-10°C (15°F)	8.8
-18°C (0°F)	8.5
Below -18°C (0°F)	8.0

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Figure 3 Battery Temperature vs. Voltage Drop

returned to service. (The battery temperature must be estimated by feel and by the temperature that the battery has been exposed to) (Figure 3).

e. If the voltage drops below the minimum, the battery must be replaced (Figure 3).

CURRENT DRAIN TEST

If a vehicle exhibits a low or dead battery after setting overnight, or the battery discharges over a period of two or three days, the electrical system should be checked for an excessive electrical drain using the following procedures:

1. Remove the underhood lamp bulb (if equipped) and turn the ignition OFF.
2. Charge the battery to a full state of charge.
3. Disconnect the negative battery cable. Connect an ammeter capable of carrying at least 20 amperes in series between the battery terminal and the negative battery cable. With the ignition OFF and all doors closed, note the amperage draw.
4. If more than a 0.5 ampere drain is present, the vehicle's electrical system should be checked by removing fuses to determine the circuit or component that is causing the drain.
5. If less than a 0.5 ampere drain is present, remove the ammeter and connect a J 34029 High Impedance Digital Multimeter in its place. Set the selector switch to 2 on the DCA scale and turn the selector switch counterclockwise until an accurate milliampere reading is obtained.

Do not open doors or operate any equipment that would draw more than 2.0 amperes or the fuse in the multimeter will blow. If the fuse blows, replace it with a 2.0 ampere fast blow fuse only. Use of any other type of fuse may cause damage to the meter.

Starting with the 2,000 MA (milliampere) setting, start switching the right selector switch down the scale until an accurate amperage reading is obtained.

Normal parasitic current drains on the battery are 10 MA to 75 MA. If more than a 75 MA drain is indicated on the multimeter, components such as the ignition switch, trunk lamps, tone generators, etc., should be checked to determine the component causing excessive drain on the battery.

ON-VEHICLE SERVICE

BATTERY CHARGING

When it is necessary to charge the battery, the following basic rules must be followed:

1. Do not charge the battery if the hydrometer is CLEAR OR LIGHT YELLOW. Replace the battery if this condition is discovered.
2. If the battery feels as hot as 52°C (125°F) or hotter, or if violent gassing or spewing of electrolyte through the vent holes occurs, discontinue charging or reduce the charging rate.
3. Do not attempt to charge a battery if it seems to be frozen.

CHARGING PROCEDURE

1. Batteries with hydrometers showing a GREEN DOT do not require charging unless they have just been discharged (by cranking the vehicle).
2. Make sure all charger connections are clean and tight.
3. For best results, batteries should be charged while the electrolyte and plates are at room temperature. A battery that is extremely cold may not accept current for several hours after starting the charger.
4. Charge the battery until the hydrometer shows a GREEN DOT. The battery should be checked every half-hour while charging. Tipping or shaking the battery may be necessary to make the hydrometer show the correct indication.
5. After charging, the battery should be tested as outlined in "Battery Testing" in this section.

CHARGING TIME REQUIRED

The time required to charge a battery will vary depending upon the following factors:

1. **Size of Battery** - A completely discharged, large heavy-duty battery requires more than twice the recharging time as is required by a completely discharged small passenger car battery.
2. **Temperature** - More time is required to charge a battery in cold temperatures than is required in warm temperatures. When a fast charger is connected to a cold battery, the current accepted by the battery will be very low at first, then as the

battery warms, a higher rate of current will be accepted.

3. **Charger Capacity** - A charge that can supply only five amperes will require more time than a charger that can supply 30 amperes.
4. **State-of-Charge** - A completely discharged battery requires more than twice as much charge as one half charged. Because the electrolyte is nearly pure water and a poor conductor in a completely discharged battery, the initial current accepted by the battery is very low. Later, as the charging current causes the electrolyte acid content to increase, the charging current will also increase.

Any battery discharged by parasitic load and left to stand in this condition for a period of time may not accept charge readily. However, if recharged long enough, most batteries will return to a usable condition.

If the battery remains in an extremely discharged condition for a prolonged period, it can become permanently damaged. This damage can be accelerated by cold temperatures. Batteries that are extremely discharged can freeze at temperatures as high as -6°C (20°F) and become permanently damaged.

To prevent damage and recharging problems, disconnect the negative battery cable from any vehicle which will not be in service for a 20 day period. If disconnecting the negative battery cable is not practical, the battery should be charged periodically (every 20-45 days).

CHARGING A COMPLETELY DISCHARGED BATTERY

The following procedure should be used when charging a very low or completely discharged battery. If this procedure is not properly followed, a good battery may be needlessly replaced.

1. Measure the voltage at the battery terminals with an accurate voltmeter. If below 10 volts, the charge current will be very low and time will be required before the battery will accept a current in excess of a few milliamperes.
2. Set the battery charger on the high setting.
3. Some chargers feature polarity protection circuitry which prevents charging unless the charger leads are connected to the battery terminals correctly. A completely discharged battery may not have enough voltage to activate this circuitry even though the leads are connected properly. If this situation occurs, follow the specific charger manufacturer's procedures for bypassing or overriding this circuitry. Bypassing the circuitry allows the charger to activate and charge a low-voltage battery.
4. Battery chargers vary in the amount of voltage and current that they can provide. The times required for the battery to accept measurable charger current at various voltages are as follows:

VOLTAGE	HOURS
16.0 or more	Up to four hours
14.0 - 15.9	Up to eight hours
13.9 or less	Up to 16 hours

5. If the charge current is still not measurable at the end of the above charging times, the battery should be replaced.
6. If the charge current is measurable during the charging time, the battery is considered good and charging should be completed in the normal manner.
7. It is important to remember that a completely discharged battery must be recharged for a sufficient number of Ampere Hours (AH) to restore it to a usable state. As a general rule, using the Reserve Capacity (RC) Rating of the battery as the number of ampere hours of charge will usually bring the desired hydrometer indication into view. For example, if the battery is rated at 75 RC minutes, it would be completely recharged as follows:

- 10 ampere charge for 7.5 hours
  = 75 ampere hours

  or
- 25 ampere charge for 3.0 hours
  = 75 ampere hours

8. Any battery recharged by this procedure should be load tested to establish serviceability - see "Diagnosis" procedures in this section.

JUMP STARTING IN CASE OF EMERGENCY WITH AUXILIARY (BOOSTER) BATTERY

NOTICE: Do not push or tow the vehicle to start engine. Damage to the emission system and/or to other parts of the vehicle may result.

Both the booster and discharged batteries should be treated carefully when using jumper cables. Follow the procedure below using caution not to generate any sparks.

CAUTION: Departure from these conditions or the procedure below could result in: (1) serious personal injury (especially to eyes) or property damage from such causes as battery explosion, battery acid, or electrical burns; and/or (2) damage to electronic components of either vehicle. Never expose any battery to open flame or electric spark - batteries generate a gas which is flammable and explosive. Remove rings, watches, and other jewelry. Wear approved eye protection. Do not allow battery fluid to contact eyes, skin, fabrics, or painted surfaces - battery fluid is a corrosive acid. Flush any contacted area with water immediately and thoroughly. Be careful that metal tools or jumper cables do not contact the positive battery terminal (or metal in contact with it) or any other metal on the vehicle - a short circuit will occur.

1. Set the parking brake and place the automatic transmission (if equipped) in PARK. Turn the

ignition OFF. Turn OFF all electrical accessories and lights.

2. Check the built-in hydrometer. If it is CLEAR OR LIGHT YELLOW, replace the battery.

NOTICE: When jump starting a vehicle with charging equipment, be sure that the equipment used is 12-volt and negative ground. **Do not use 24-volt charging equipment. Using such equipment can cause serious damage to the vehicle's electrical system or electronic components.**

3. Attach the end of one jumper cable to the positive terminal of the booster battery and the other end of the same cable to the positive terminal of the discharged battery. Do not permit the vehicles to touch one another. If the vehicles touch, they may create a grounding effect and counteract the jumping procedure.
4. Attach one end of the negative jumper cable to the negative terminal of the booster battery and the other end to the solid engine ground (such as A/C compressor bracket). Make sure that the ground is at least 18 inches away from the discharged battery. **Do not connect directly to the negative terminal of the discharged battery.**
5. Start the engine of the vehicle that is providing the jump start and turn OFF all electrical accessories and lights. Start the engine of the vehicle with the discharged battery.
6. Reverse these directions exactly when removing the jumper cables. The negative cable must be disconnected from the engine that was jump started first.

BATTERY REPLACEMENT

Figure 4

Remove or Disconnect

1. Negative battery cable from battery.
2. Positive battery cable from battery.
3. Two retainer nuts and retainer.
4. Battery.

Install or Connect

1. Battery.
2. Battery retainer top bracket with two nuts.

Tighten

- Retainer nuts to 8 N·m (6 lb.ft.).

3. Positive battery cable to battery.
4. Negative battery cable to battery.

Tighten

- Battery cables to 12 N·m (9 lb.ft.).

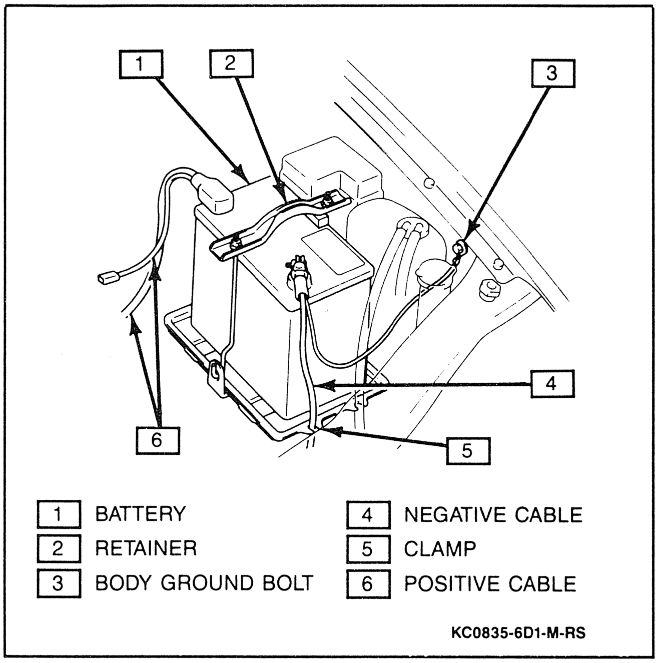

Figure 4 Battery And Cable Replacement

BATTERY CABLE REPLACEMENT AND ROUTING

Whenever battery cables are being replaced, always be certain to use a replacement cable that is the same type and length. Some positive cables have additional feed wires attached to them and some negative cables have additional ground leads attached.

Always be certain to route the replacement battery cable in exactly the same manner as the original cable.

NEGATIVE BATTERY CABLE

Figure 4

Remove or Disconnect

1. Battery (See Battery Replacement in this section).
2. Engine coolant reservoir by pulling straight up and placing it out of the way.
3. Ground bolt from body.
4. Ground bolt from transmission.
5. Cable from clamp at battery retainer.
6. Negative battery cable from vehicle.

Install or Connect

1. Ground bolt to transmission.

Tighten

- Transmission ground bolt (Manual Transmission) to 23 N·m (17 lb.ft.).
- Transmission ground bolt (Automatic Transmission) to 50 N·m (37 lb.ft.).

2. Ground bolt to body.

Tighten

- Body ground bolt to 8 N·m (6 lb.ft.).

3. Engine coolant reservoir.

4. Cable to clamp at battery retainer.
5. Battery (See Battery Replacement in this section).

POSITIVE BATTERY CABLE

Remove or Disconnect

1. Battery (See Battery Replacement in this section).
2. Smaller diameter cable from bottom of Underhood Fuse and Relay Center by squeezing lock on connector and pulling straight down.
3. Nut and larger diameter cable from starter solenoid.
4. Three clamps.
5. Positive battery cable from vehicle.

Install or Connect

1. Larger diameter cable and nut to starter solenoid.

   Tighten

   - Nut to 7 N·m (5 lb.ft.).
2. Smaller diameter cable to bottom of Underhood Fuse and Relay Center.
3. Three clamps.
4. Battery (See Battery Replacement in this section).

BATTERY USAGE

REPLACEMENT NUMBER	TEST LOAD AMPS	COLD CRANKING AMPS	RESERVE CAPACITY MINUTES
26-50S	200	390	50

TORQUE SPECIFICATIONS

Battery Retainer Nuts	8 N·m (6 lb.ft.)
Battery Cables	12 N·m (9 lb.ft.)
Transmission Ground Bolt (Manual Transmission)	23 N·m (17 lb.ft.)
Transmission Ground Bolt (Automatic Transmission)	50 N·m (37 lb.ft.)
Body Ground Bolt	8 N·m (6 lb.ft.)
Starter Solenoid Nut	7 N·m (5 lb.ft.)

SPECIAL TOOLS

J 34029	High Impedance Digital Multimeter

SECTION 6D2

CRANKING SYSTEM

CONTENTS

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CRANKING CIRCUIT 6D2-1
STARTER MOTOR 6D2-1
DIAGNOSIS 6D2-2
STARTER ASSEMBLY
  PERFORMANCE TESTING 6D2-2
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GENERAL DESCRIPTION

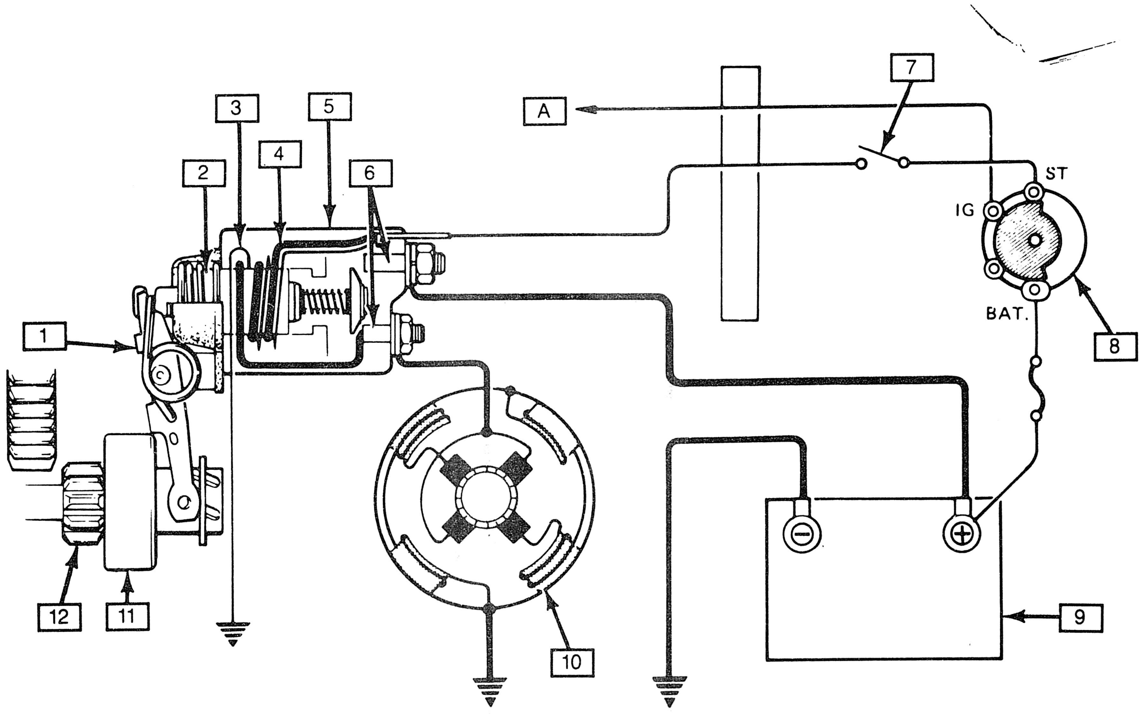
CRANKING CIRCUIT

The cranking circuit consists of the battery, starter motor, ignition switch, and related electrical wiring. All of these components are connected electrically (Figure 1). Only the starter motor, however, will be covered in this section.

STARTER MOTOR

Two types of starter motors are utilized depending upon the vehicle transmission application. Manual transmission equipped vehicles utilize conventional starter motors which consist of a frame and field assembly, an armature assembly, an overrunning clutch assembly, a starter solenoid assembly, a commutator end housing, a brush holder, and a shift lever. Automatic transmission equipped vehicles utilize a reduction type starter motor which has, in addition to the components mentioned above, a reduction gear and shock absorber assembly.

In the basic circuit, the solenoid windings are energized when the ignition switch is turned to START and the clutch start/neutral safety switch is closed. The resulting plunger and shift lever movement causes the pinion to engage the engine flywheel ring gear. This movement also causes the starter solenoid contacts to close. With the contacts closed, the starter solenoid provides a closed circuit between the battery positive terminal and the starter motor. Because the starter motor is permanently grounded to the engine block, the circuit is complete and cranking occurs as soon as the starter solenoid contacts are closed. When the engine starts, the pinion is designed to overrun and protect the armature from excessive speed until the ignition switch is released from the START position. With the ignition switch released, a return spring in the solenoid assembly forces the starter solenoid contacts open, breaks the circuit between the battery and the starter motor, and disengages the pinion. To prevent prolonged overrun, the ignition switch should be released immediately upon engine start-up.



A	TO DISTRIBUTOR
1	SHIFT LEVER
2	PLUNGER
3	HOLD-IN COIL
4	PULL-IN COIL
5	STARTER SOLENOID
6	STARTER SOLENOID CONTACTS
7	CLUTCH START SWITCH (MANUAL TRANSMISSION) NEUTRAL SAFETY SWITCH (AUTOMATIC TRANSMISSION)
8	IGNITION SWITCH
9	BATTERY
10	STARTER MOTOR
11	OVERRUNNING CLUTCH
12	PINION

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Figure 1 Cranking Circuit

DIAGNOSIS

Before removing any unit in the cranking circuit for repair, the following checks should be made:

Battery: To determine the condition of the battery, follow the testing procedure outlined in the Battery Section 6D1.

Wiring: Inspect for wiring damage. Inspect the connections to the starter motor, the starter solenoid, the ignition switch, the battery, and all related ground points.

Starter Solenoid and Ignition Switch: Inspect these components and determine their serviceability.

Starter Motor: If the battery, wiring, and switches are in satisfactory condition, and the engine is known to be functioning properly, remove the starter motor (See procedure in this section) and perform "Starter Assembly Performance Testing."

STARTER ASSEMBLY PERFORMANCE TESTING

Remove or Disconnect

1. Starter assembly (See procedure in this section).

PULL-IN TEST

Remove or Disconnect

1. Starter-to-solenoid wire from solenoid terminal.

Install or Connect

1. Test leads from battery to starter assembly (Figure 2).

Inspect

- Check that the pinion extends quickly and completely to the energized position.

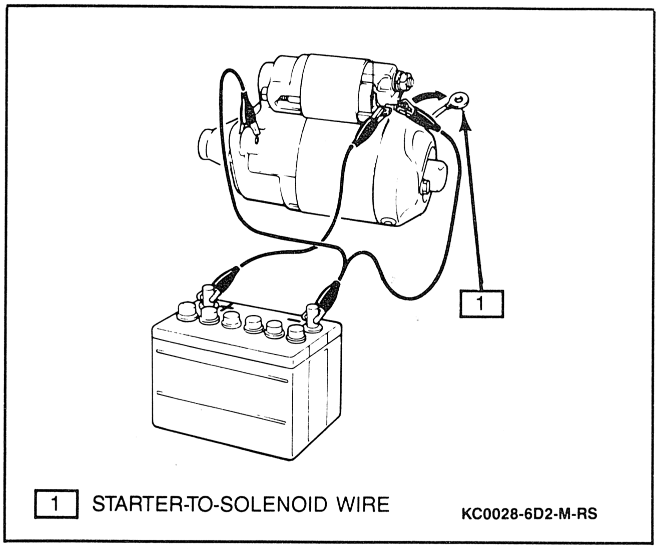


Figure 2 Pull-In Test

- If pinion movement is satisfactory, proceed to the "Hold-In Test."
- If pinion movement is not satisfactory, replace the starter solenoid (See "Unit Repair" procedure in this section).

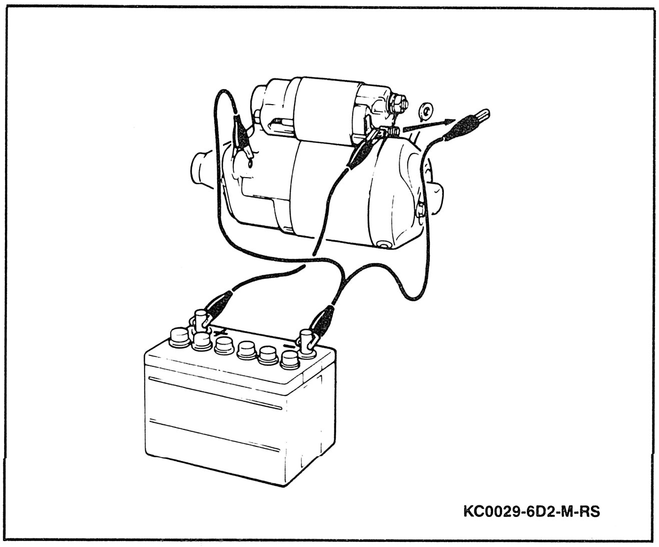


Figure 3 Hold-In Test

HOLD-IN TEST

Remove or Disconnect

1. Negative test lead from starter-to-solenoid wire solenoid terminal (Figure 3).

Inspect

- Check that the pinion remains completely in the energized position.
- If the pinion remains in the energized position proceed to the "Pinion Return Test."
- If the pinion does not remain completely in the energized position, replace the starter solenoid (See Unit Repair procedure in this section).

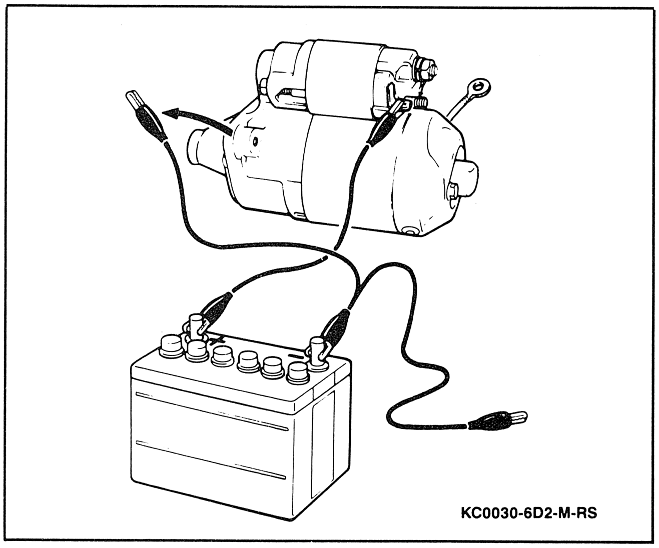


Figure 4 Pinion Return Test

PINION RETURN TEST

Remove or Disconnect

1. Negative lead from drive housing assembly (Figure 4).

Inspect

- Check that the pinion returns quickly and completely to the de-energized position.
- If the pinion returns quickly and completely to the de-energized position, proceed to the "No-Load Performance Test."
- If the pinion does not return to the de-energized position, the cause is most likely a faulty starter solenoid return spring. Replace the starter solenoid (See "Unit Repair" procedure in this section) and retest. If, after solenoid replacement, the pinion does not return satisfactorily to the de-energized position, proceed to "Unit Repair" for further disassembly and inspection procedures.

NO-LOAD PERFORMANCE TEST

Install or Connect

1. Test leads from battery to starter assembly and ammeter (Figure 5).

Inspect

- Check that the starter motor runs smoothly and that the pinion extends quickly and completely.
- During starter motor operation, check that the ammeter reads no more than 50 amperes

for manual transmission equipped vehicles and no more than 90 amperes for automatic transmission equipped vehicles.

- If the starter assembly performs satisfactorily and the ammeter readings are within the specified limits, the starter assembly is serviceable and should be reinstalled on the vehicle. If a cranking complaint exists, the starter should not be considered faulty and further diagnosis is necessary.
- If the starter assembly does not perform satisfactorily during this test, proceed to "Unit Repair" for further disassembly and inspection procedures.

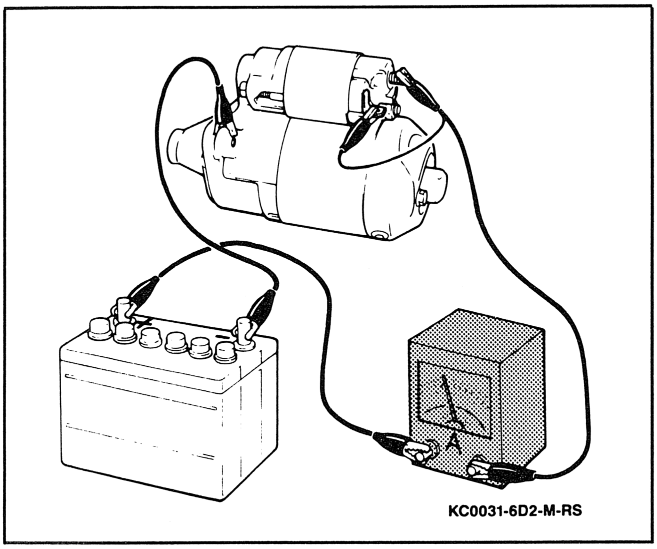


Figure 5 No-Load Performance Test

ON-VEHICLE SERVICE

STARTER ASSEMBLY

Remove or Disconnect

1. Battery negative cable from battery.
2. Battery positive cable from starter solenoid.
3. Two starter assembly mounting bolts (Figure 6).
4. Starter assembly.

Install or Connect

1. Starter assembly with two mounting bolts.

   Tighten

   - Starter assembly mounting bolts to 23 N·m (17 lb.ft.).

2. Battery positive cable to starter solenoid.
3. Battery negative cable to battery.

   Tighten

   - Battery cables to 12 N·m (9 lb.ft.).

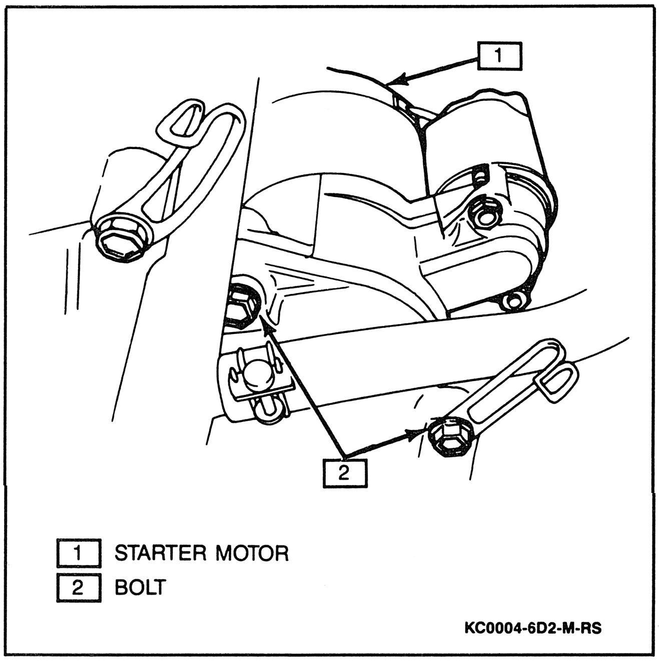


Figure 6 Starter Assembly Removal

UNIT REPAIR

STARTER SOLENOID

Remove or Disconnect

1. Nut and starter-to-solenoid wire from solenoid.
2. Two mounting nuts from drive housing assembly side.
3. Pull up and out on starter solenoid to disconnect plunger hook from shift lever (Figure 7).
4. Starter solenoid.

Install or Connect

1. Lightly grease plunger hook with GM #1050109.
2. Plunger hook to shift lever with boot breather facing downward (Figure 8).
3. Starter solenoid with two mounting nuts on drive housing assembly side.

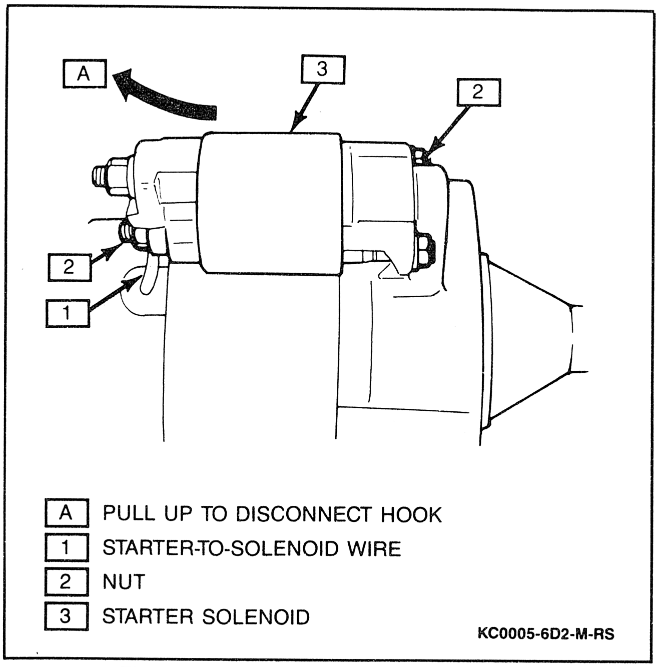


Figure 7 Starter Solenoid Removal

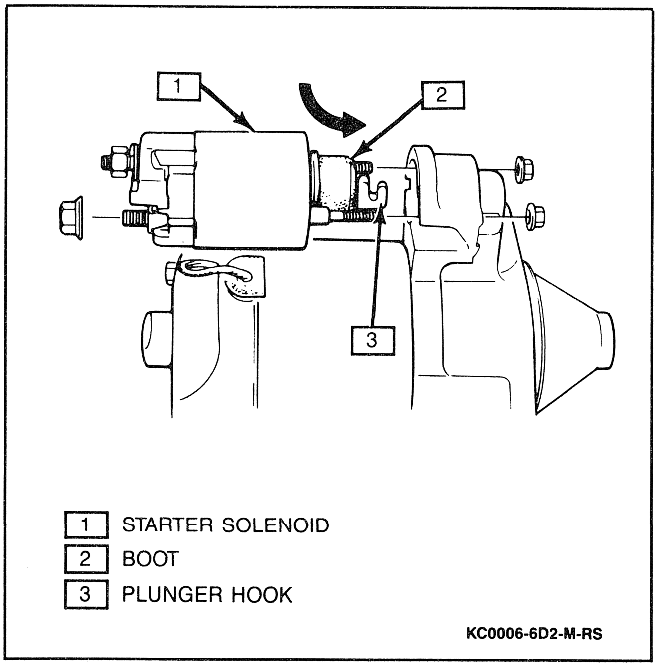


Figure 8 Starter Solenoid Installation

Tighten

- Starter solenoid nuts to 7 N·m (5 lb.ft.).

4. Starter-to-solenoid wire and nut.

Tighten

- Wire nut to 10 N·m (7.5 lb.ft.).

STARTER ASSEMBLY

Manual Transmission Equipped Vehicles

Disassemble

1. Remove the starter solenoid (See procedure in this section).
2. Remove two screws, commutator end cap, armature plate, and brake spring (Figure 11).
3. Remove two housing bolts (through bolts) and disconnect commutator end housing.
4. Using needle nose pliers, remove the brushes (Figure 12).
5. Remove the brush holder.
6. Remove the frame and field assembly, the armature, and the shift lever (Figure 13).
7. Using snap ring pliers, remove the armature snap ring, the pinion stop ring, and the overrunning clutch (Figure 14).

Automatic Transmission Equipped Vehicles

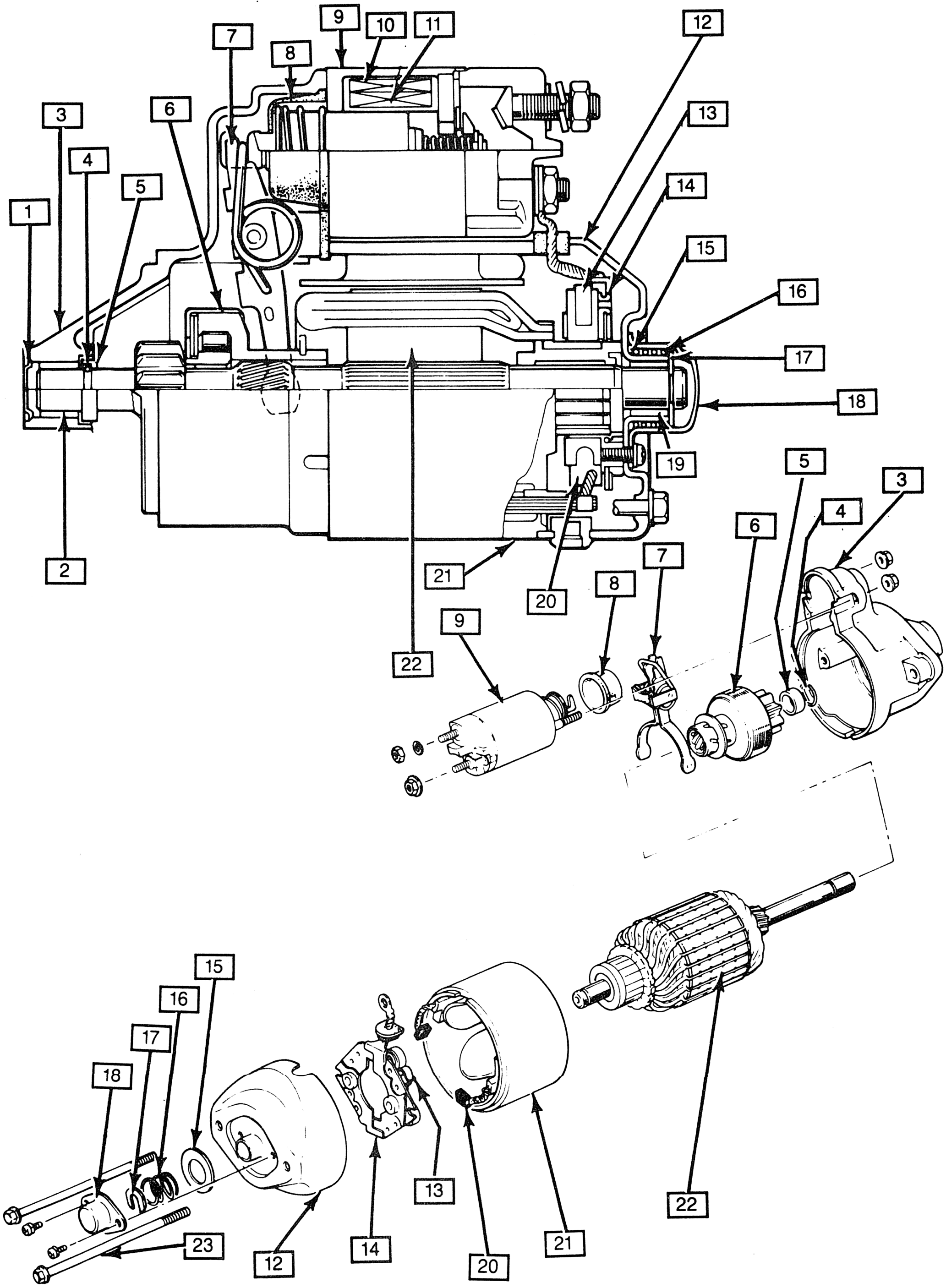
Disassemble

1. Remove the starter solenoid (See procedure in this section).
2. Remove the two commutator housing bolts (Figure 15).
3. Using needle nose pliers, remove the brushes (Figure 10).
4. Remove the armature and the brush holder.
5. Remove the frame and field assembly.
6. Remove the plate (Figure 16).
7. Using snap ring pliers, remove the snap ring and the C-clip from the planetary carrier shaft (Figures 17 and 18).
8. Remove the shift lever.
9. Remove the pinion stop ring, the overrunning clutch, and the washer from the planetary carrier shaft.
10. Remove the planetary carrier shaft from the center bearing and shock absorber.
11. Remove the planetary gears and the washer from the planetary carrier shaft.
12. Remove the internal gear from the center bearing and shock absorber (Figure 19).

Manual and Automatic Transmission Equipped Vehicles

Inspect

1. Check the insulation between the commutator segments and the armature core with an ohmmeter (Figure 20). If continuity exists, the armature must be replaced.
2. Check for continuity between the segments (Figure 21). If continuity does not exist at all test points, the armature must be replaced.
3. Support the armature on V-blocks and check the commutator for run-out using a J 7872 Dial Gage (Figure 22). Run-out must not exceed 0.4 mm (0.015 in.) for manual transmission equipped vehicles or 0.5 mm (0.020 in.) for automatic transmission equipped vehicles. If the commutator run-out exceeds these limits, the armature must either be replaced or corrected on a lathe.



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1	COVER	10	HOLD-IN COIL	19	BUSHING
2	BUSHING	11	PULL-IN COIL	20	BRUSH
3	DRIVE HOUSING ASSEMBLY	12	COMMUTATOR END HOUSING ASSEMBLY	21	FRAME AND FIELD ASSEMBLY
4	SNAP RING	13	BRUSH SPRING	22	ARMATURE
5	PINION STOP RING	14	BRUSH HOLDER ASSEMBLY	23	HOUSING BOLT
6	OVERRUNNING CLUTCH ASSEMBLY	15	END CAP GASKET		
7	SHIFT LEVER	16	ARMATURE BRAKE SPRING		
8	BOOT	17	ARMATURE PLATE		
9	STARTER SOLENOID	18	COMMUTATOR END CAP		

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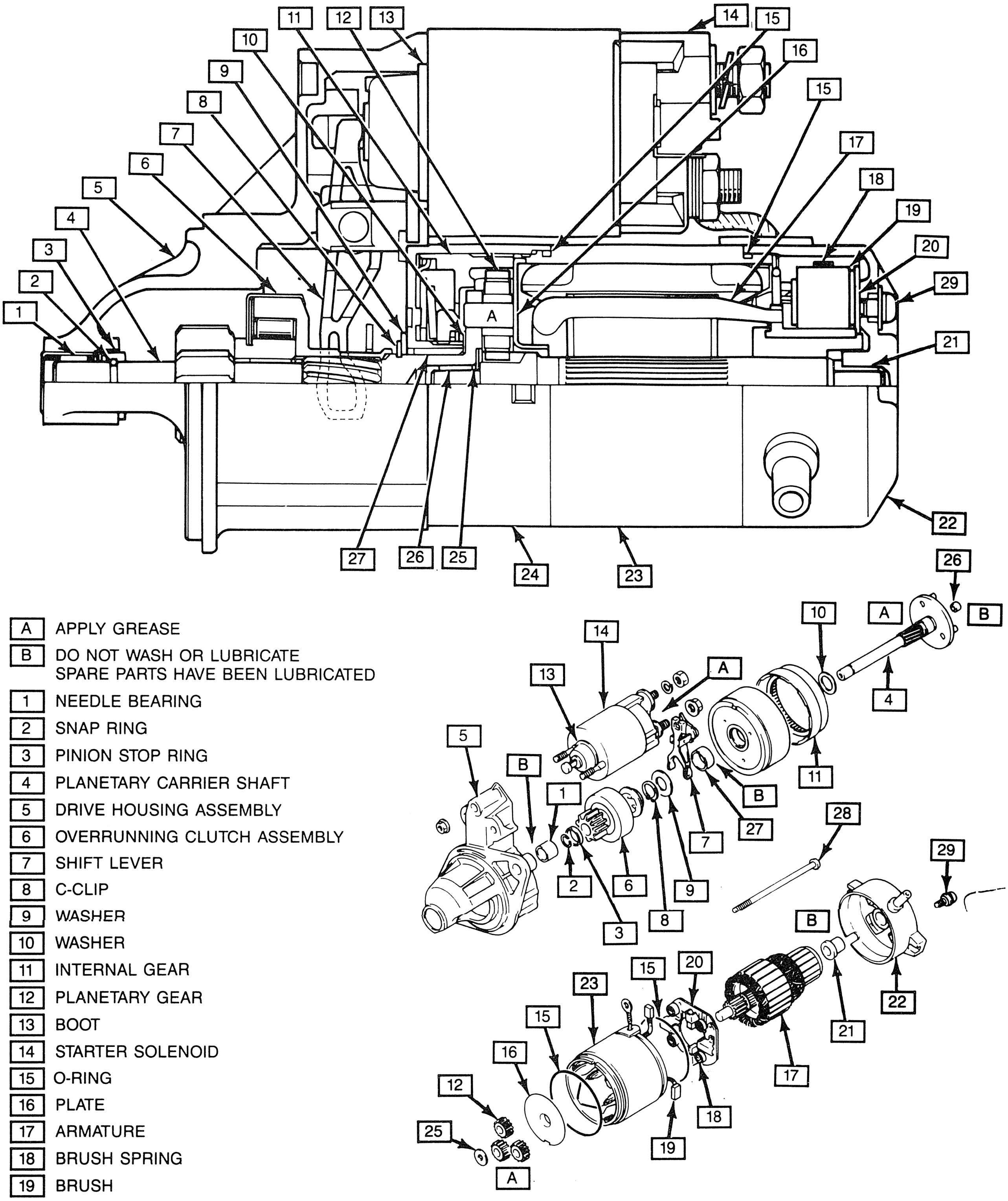
Figure 9 Starter Assembly - Manual Transmission Vehicles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A

A	APPLY GREASE
B	DO NOT WASH OR LUBRICATE SPARE PARTS HAVE BEEN LUBRICATED
1	NEEDLE BEARING
2	SNAP RING
3	PINION STOP RING
4	PLANETARY CARRIER SHAFT
5	DRIVE HOUSING ASSEMBLY
6	OVERRUNNING CLUTCH ASSEMBLY
7	SHIFT LEVER
8	C-CLIP
9	WASHER
10	WASHER
11	INTERNAL GEAR
12	PLANETARY GEAR
13	BOOT
14	STARTER SOLENOID
15	O-RING
16	PLATE
17	ARMATURE
18	BRUSH SPRING
19	BRUSH
20	BRUSH HOLDER ASSEMBLY
21	BUSHING
22	COMMUTATOR END HOUSING ASSEMBLY
23	FRAME AND FIELD ASSEMBLY
24	CENTER BEARING AND SHOCK ABSORBER ASSEMBLY
25	WASHER
26	BUSHING
27	BUSHING
28	HOUSING BOLT
29	SCREW WITH O-RING

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Figure 10 Starter Assembly - Automatic Transmission Vehicles

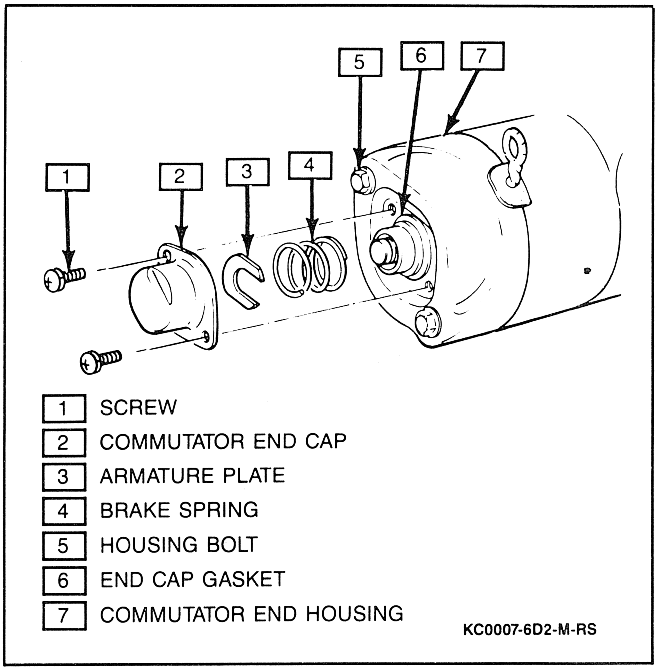

5
6
7
1
2
3
4
1 SCREW
2 COMMUTATOR END CAP
3 ARMATURE PLATE
4 BRAKE SPRING
5 HOUSING BOLT
6 END CAP GASKET
7 COMMUTATOR END HOUSING
KC0007-6D2-M-RS

Figure 11 Commutator End Cap Removal

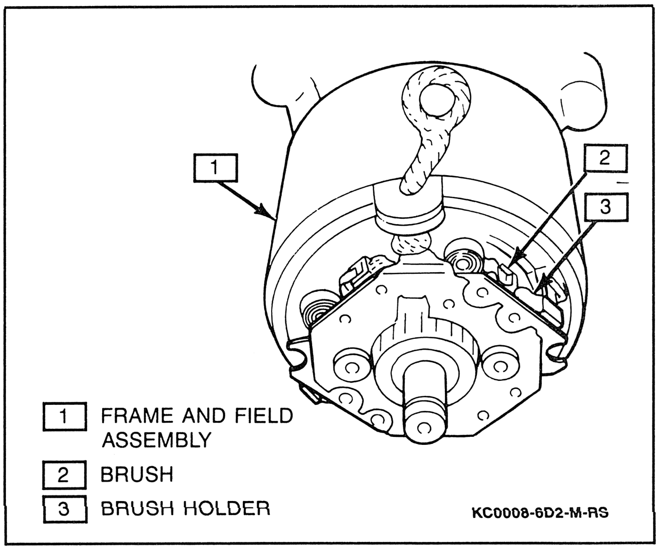

1
2
3
1 FRAME AND FIELD ASSEMBLY
2 BRUSH
3 BRUSH HOLDER
KC0008-6D2-M-RS

Figure 12 Brush and Brush Holder Removal

4. Check the diameter of the commutator (Figure 23). The diameter should be no less than 27 mm (1.063 in.).
5. Check the commutator mica depth (Figure 24). Mica depth should be no less than 0.2 mm (0.008 in.).

Clean

- Mica surface with #400 emery cloth.

6. Check the field coil for continuity. Continuity should exist between the brush and the frame and field assembly.
7. Measure the length of the brushes (Figure 25). Brush length should be no less than 10.7 mm (0.421 in.) for manual transmission equipped vehicles and no less than 9.0 mm (0.354 in.) for automatic transmission equipped vehicles. Replace as required.

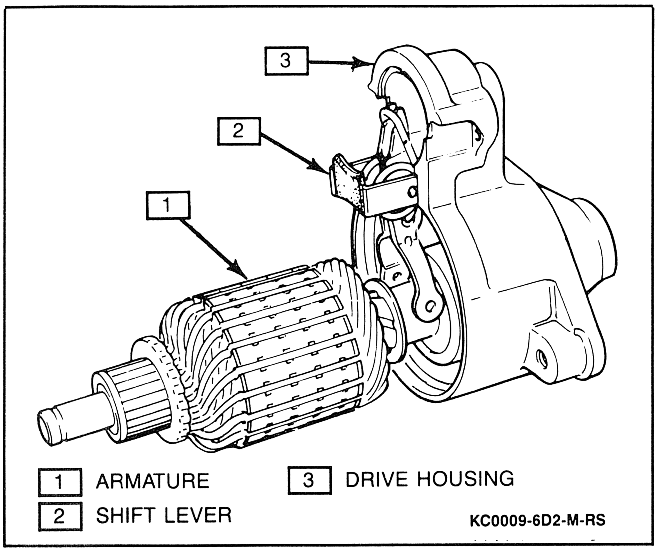

3
2
1
1 ARMATURE
2 SHIFT LEVER
3 DRIVE HOUSING
KC0009-6D2-M-RS

Figure 13 Armature and Shift Lever

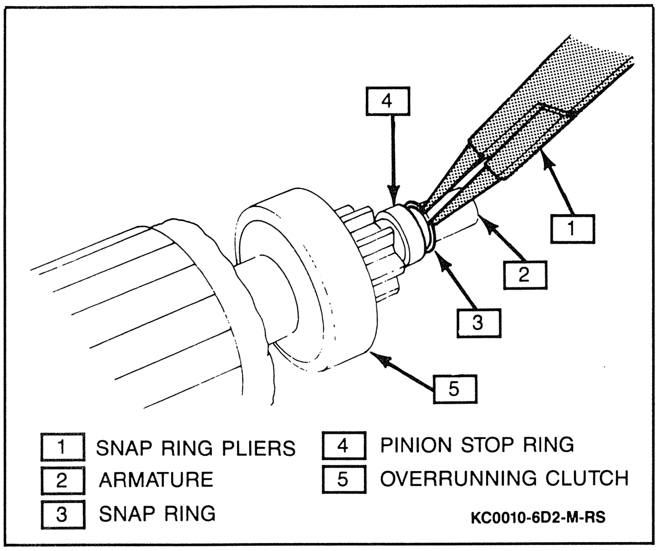

4
1
2
3
5
1 SNAP RING PLIERS
2 ARMATURE
3 SNAP RING
4 PINION STOP RING
5 OVERRUNNING CLUTCH
KC0010-6D2-M-RS

Figure 14 Snap Ring Removal

8. Check the brush springs for corrosion or damage. Also check the brush holder for corrosion and the insulation on the positive plates for wear. Replace components as needed.
9. Check the overrunning clutch for free rotation in the correct direction (Figure 26) and that it locks securely in the opposite direction. Also check the pinion for abnormal wear. Replace as an assembly if required.
10. **Manual Transmission Equipped Vehicles Only** Measure the clearance between the drive end housing bushing inner diameter and the armature shaft outer diameter (Figure 27). Clearance should be no greater than 0.2 mm (0.008 in.). If the clearance exceeds this specification, press-fit a new bushing. After press-fitting, ream the replacement bushing to obtain a 0.05 mm (0.002 in.) clearance. Lightly grease the bushing with GM #1050109. Caulk the cover if the front bushing was replaced.

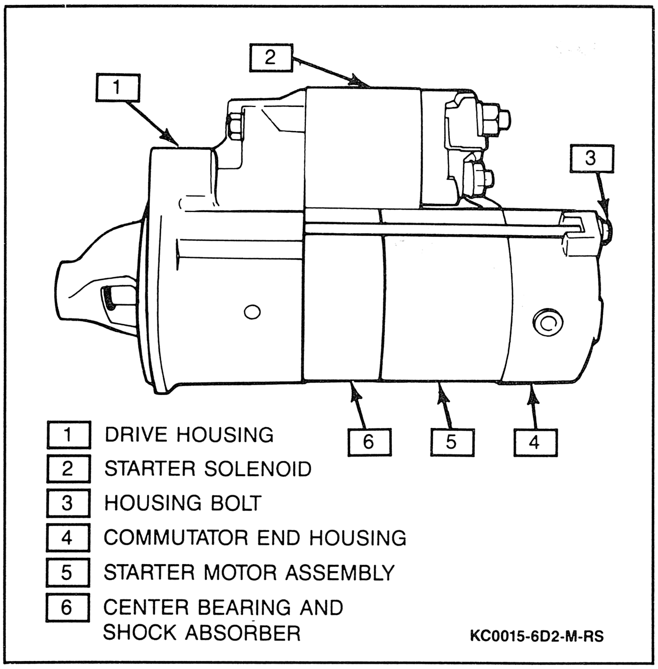

1
2
3
6
5
4
1 DRIVE HOUSING
2 STARTER SOLENOID
3 HOUSING BOLT
4 COMMUTATOR END HOUSING
5 STARTER MOTOR ASSEMBLY
6 CENTER BEARING AND SHOCK ABSORBER
KC0015-6D2-M-RS

Figure 15 Starter Disassembly - Automatic Transmission Vehicles

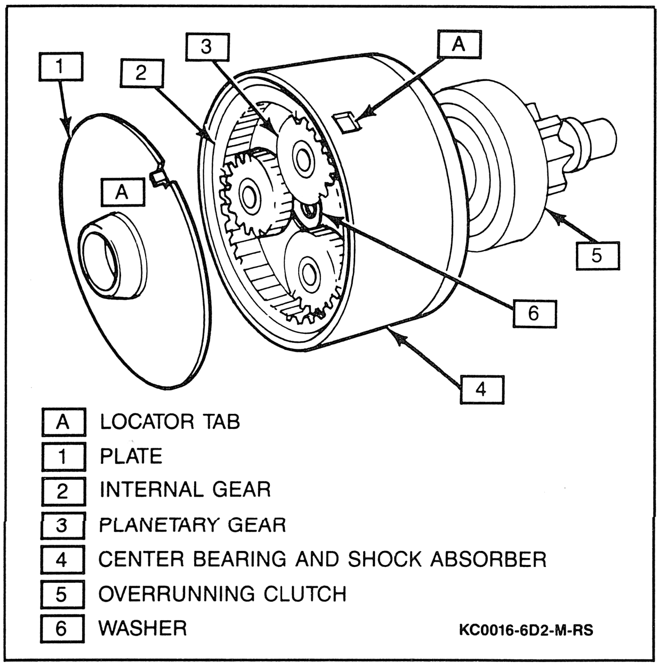

1
2
3
A
A
5
6
4
A LOCATOR TAB
1 PLATE
2 INTERNAL GEAR
3 PLANETARY GEAR
4 CENTER BEARING AND SHOCK ABSORBER
5 OVERRUNNING CLUTCH
6 WASHER
KC0016-6D2-M-RS

Figure 16 Center Bearing and Shock Absorber

Manual Transmission Equipped Vehicles

Assemble

1. Lightly grease the armature shaft with GM #1050109 and install the overrunning clutch onto the shaft (Figure 28). Install the pinion stop ring and the snap ring.
2. Lightly grease the shift lever with GM #1050109 and connect the shift lever to the armature (Figure 29). Assemble the shift lever and the armature onto the drive end housing.
3. Install the brush holder on the frame and field assembly (Figure 30).
4. Install the four brushes and springs.

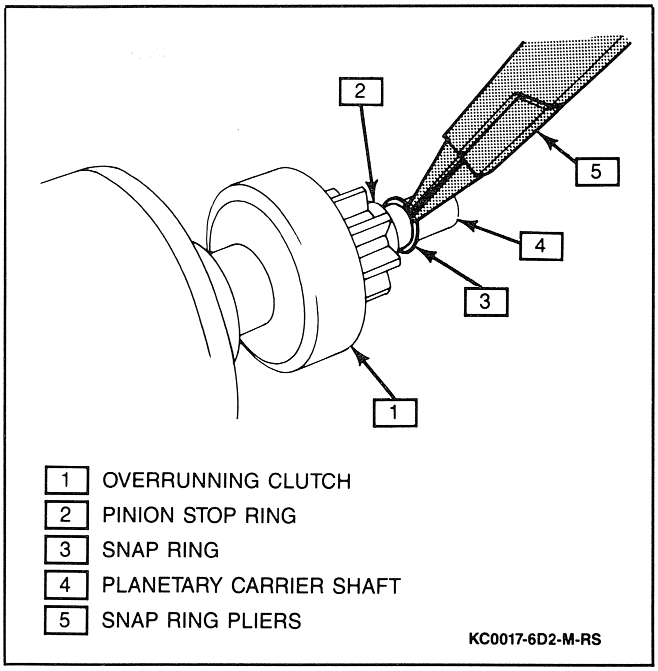

2
5
4
3
1
1 OVERRUNNING CLUTCH
2 PINION STOP RING
3 SNAP RING
4 PLANETARY CARRIER SHAFT
5 SNAP RING PLIERS
KC0017-6D2-M-RS

Figure 17 Snap Ring Removal

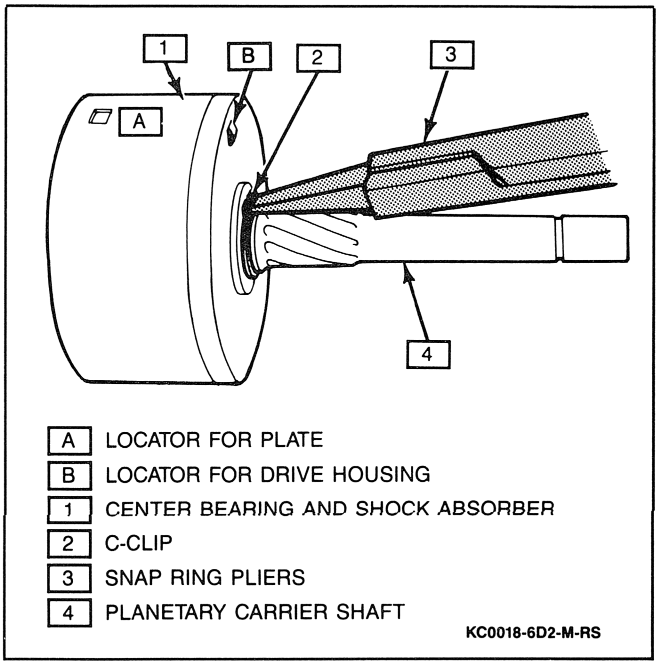

1
B
2
3
A
4
A LOCATOR FOR PLATE
B LOCATOR FOR DRIVE HOUSING
1 CENTER BEARING AND SHOCK ABSORBER
2 C-CLIP
3 SNAP RING PLIERS
4 PLANETARY CARRIER SHAFT
KC0018-6D2-M-RS

Figure 18 C-Clip Removal

Inspect

- Check that the brushes and the commutator are clean before installation.

5. Lightly grease the inside of the commutator end housing bushing with GM #1050109 and install the commutator end housing.

Tighten

- Commutator end housing bolts to 8 N·m (6 lb.ft.).

6. Install the gasket, brake spring, and armature plate (Figure 31).

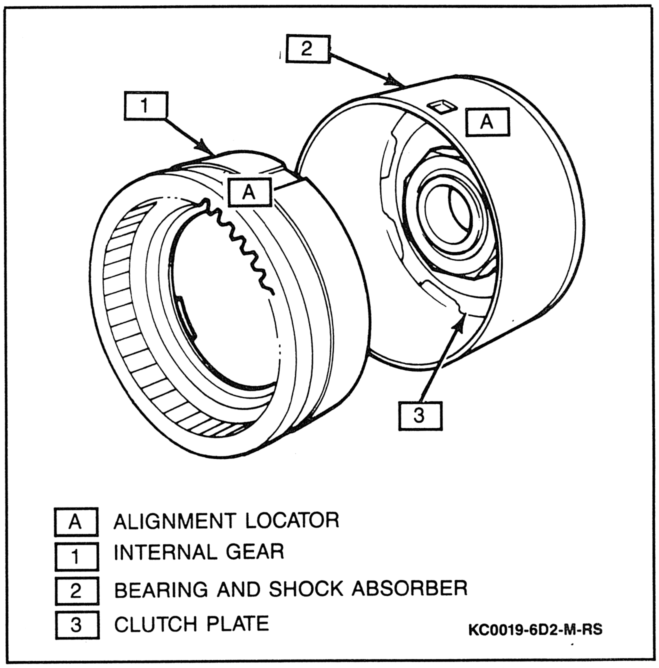

1
2
A
A
3
A ALIGNMENT LOCATOR
1 INTERNAL GEAR
2 BEARING AND SHOCK ABSORBER
3 CLUTCH PLATE
KC0019-6D2-M-RS

Figure 19 Internal Gear Removal

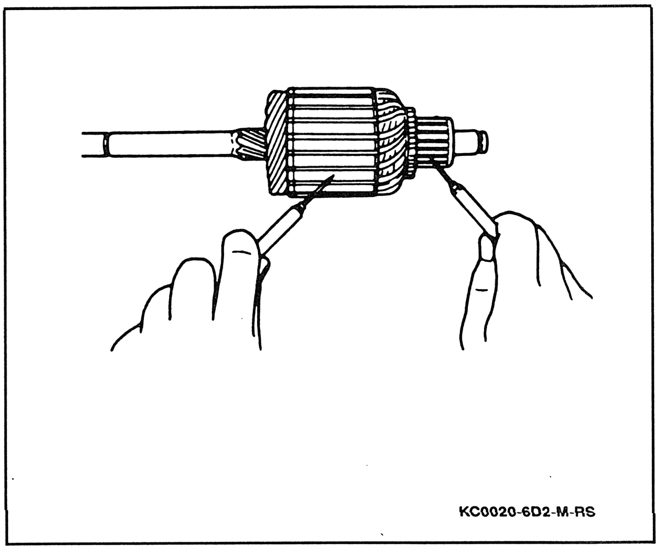

KC0020-6D2-M-RS

Figure 20 Commutator Insulation Inspection

7. Fill the commutator end cap half full of GM #1050109 grease and install the cap using the two screws.
8. Install the starter solenoid (See procedure in this section).

Automatic Transmission Equipped Vehicles

Assemble

1. Install the internal gear into the center bearing and shock absorber.
2. Install the washer and the planetary gears onto the planetary carrier shaft.
3. Install the washer onto the planetary carrier shaft and insert the shaft into the center bearing and shock absorber.

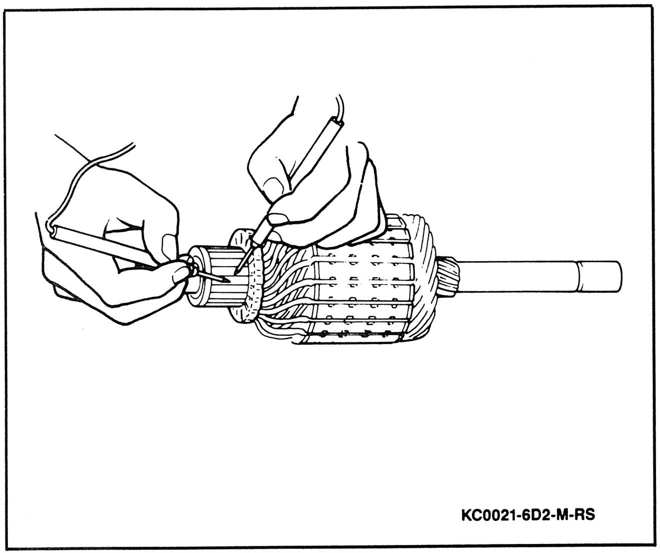

KC0021-6D2-M-RS

Figure 21 Commutator Segment Continuity Inspection

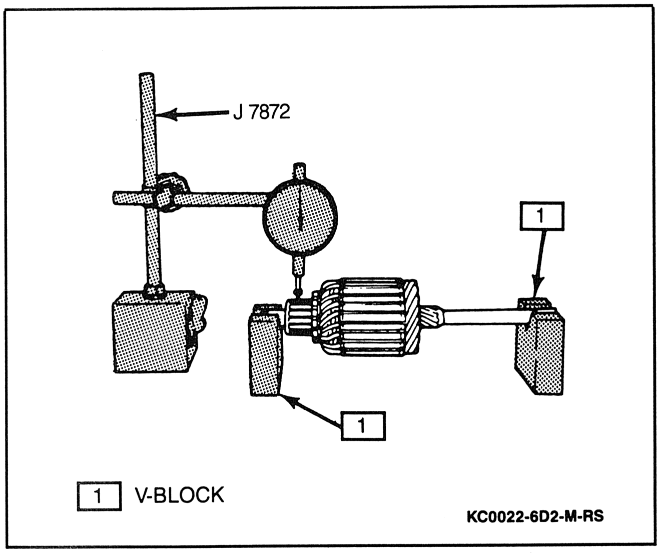

J 7872
1
1
1 V-BLOCK
KC0022-6D2-M-RS

Figure 22 Commutator Run-Out Inspection

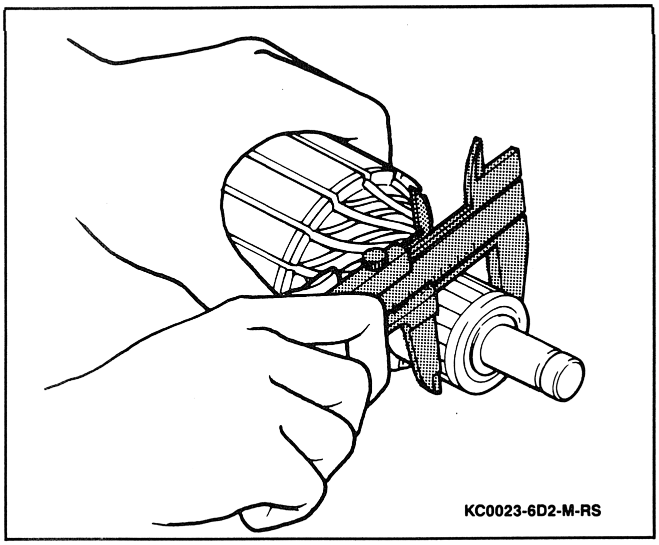

KC0023-6D2-M-RS

Figure 23 Commutator Diameter Inspection

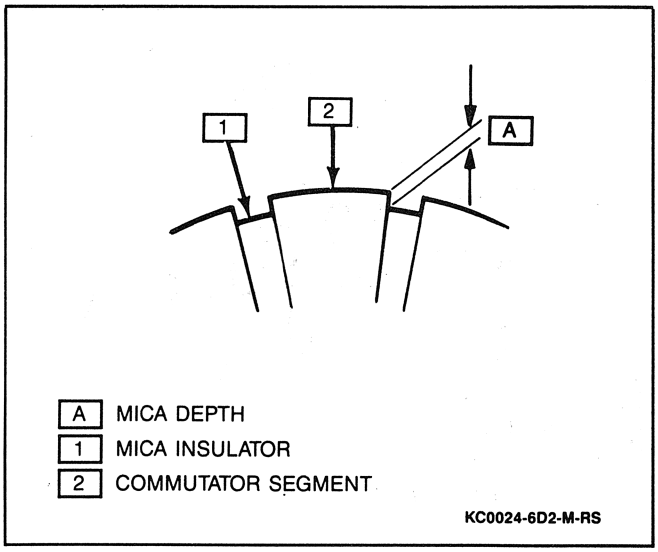

1
2
A
A MICA DEPTH
1 MICA INSULATOR
2 COMMUTATOR SEGMENT
KC0024-6D2-M-RS

Figure 24 Mica Depth Inspection

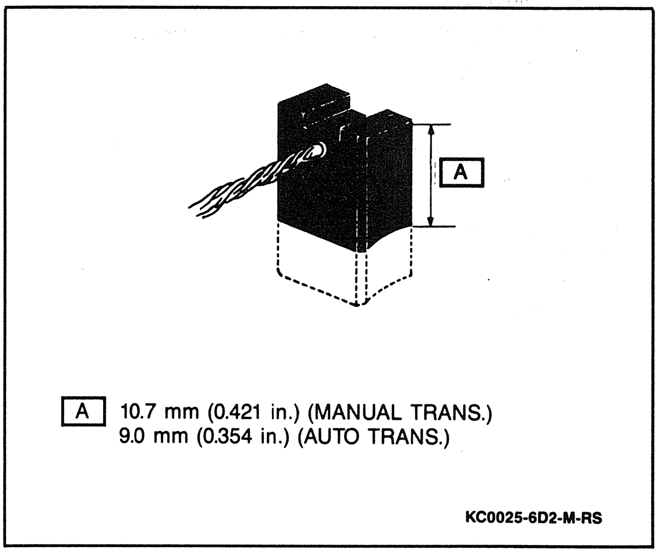

A
A 10.7 mm (0.421 in.) (MANUAL TRANS.)
9.0 mm (0.354 in.) (AUTO TRANS.)
KC0025-6D2-M-RS

Figure 25 Brush Length Inspection

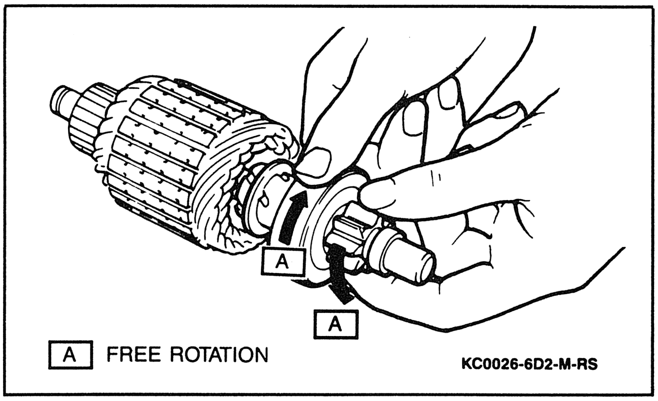

A
A
A FREE ROTATION
KC0026-6D2-M-RS

Figure 26 Overrunning Clutch Rotation Inspection

4. Install the washer, the overrunning clutch, and the pinion stop ring onto the planetary carrier shaft.
5. Using snap ring pliers, install the snap ring and the C-clip onto the planetary shaft carrier.
6. Install the shift lever.

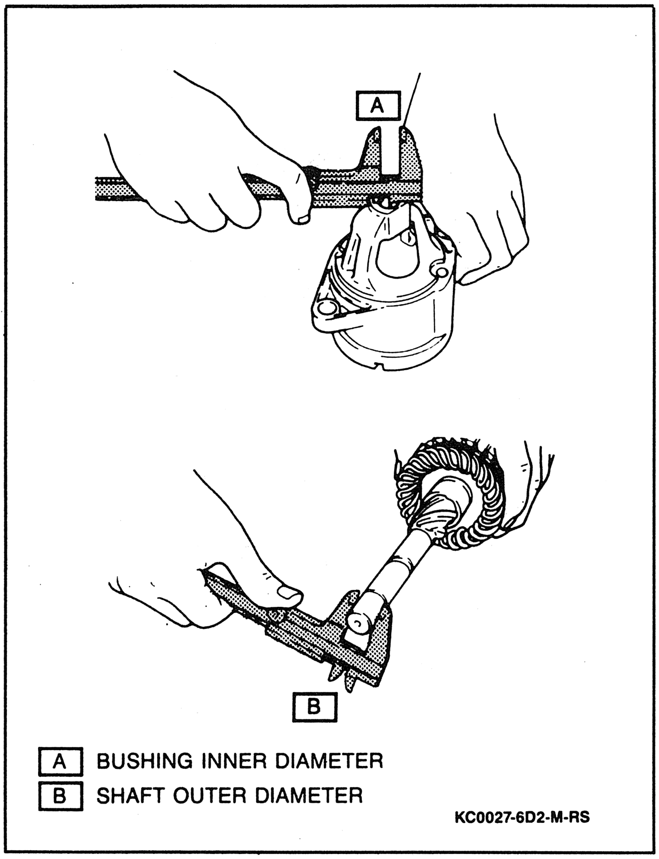

A
B
A BUSHING INNER DIAMETER
B SHAFT OUTER DIAMETER
KC0027-6D2-M-RS

Figure 27 Bushing-to-Shaft Clearance Inspection

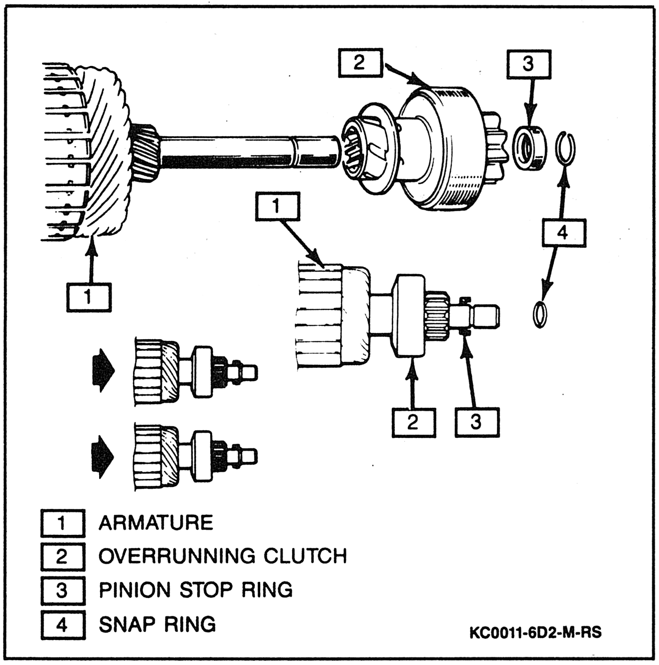

2
3
1
4
1
2
3
1 ARMATURE
2 OVERRUNNING CLUTCH
3 PINION STOP RING
4 SNAP RING
KC0011-6D2-M-RS

Figure 28 Armature Shaft Assembly

7. Insert the needle bearing and the planetary carrier shaft into the drive housing assembly.
8. Install the plate.
9. Install the frame and field assembly with two O-rings.
10. Install the brush holder and the armature.
11. Using needle nose pliers, install the four brushes and springs.

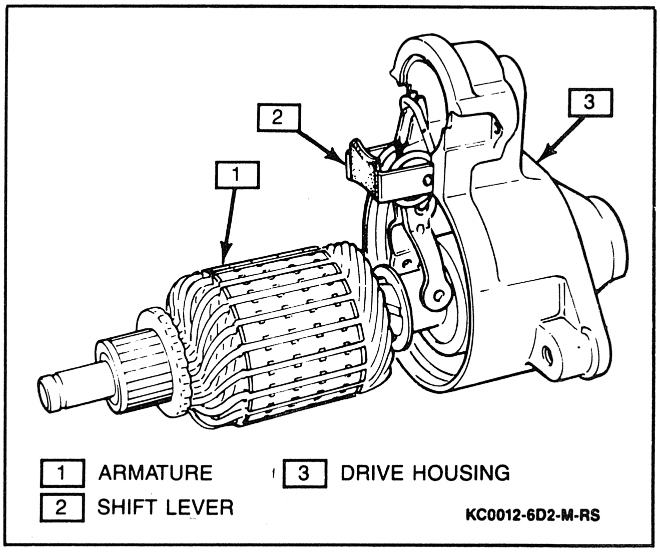

1
2
3
1 ARMATURE
2 SHIFT LEVER
3 DRIVE HOUSING
KC0012-6D2-M-RS

Figure 29 Shift Lever Installation

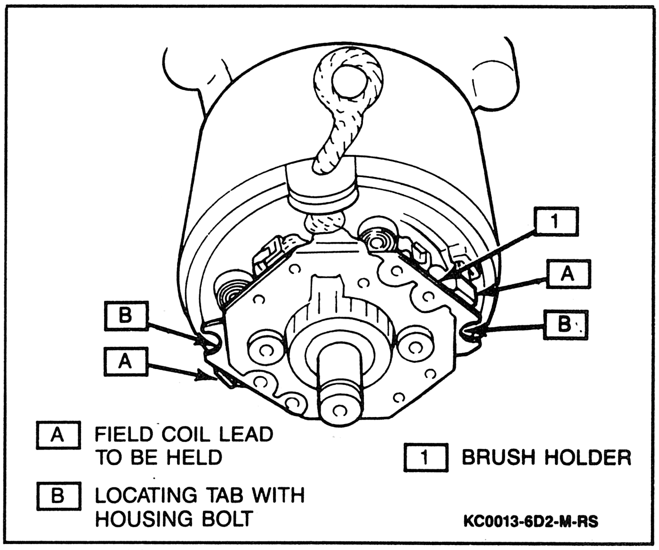

1
A
B
B
A
A FIELD COIL LEAD TO BE HELD
B LOCATING TAB WITH HOUSING BOLT
1 BRUSH HOLDER
KC0013-6D2-M-RS

Figure 30 Brush and Brush Holder Installation

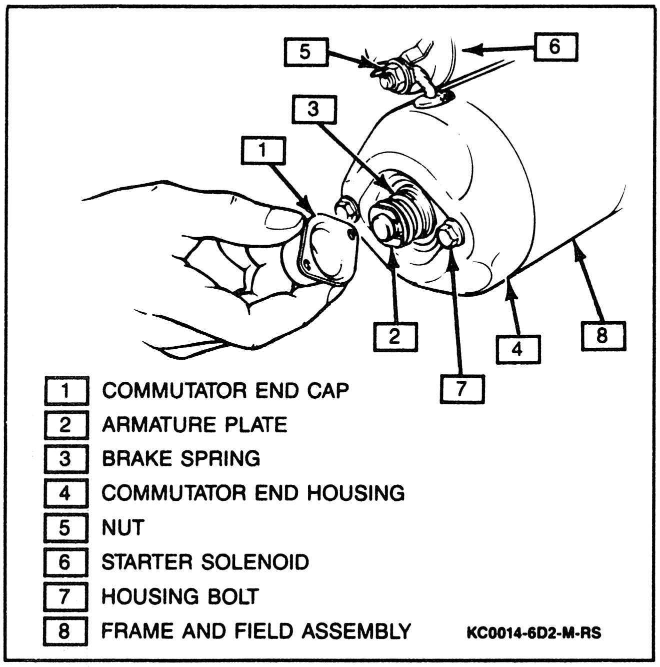

5
6
3
1
2
4
8
7
1 COMMUTATOR END CAP
2 ARMATURE PLATE
3 BRAKE SPRING
4 COMMUTATOR END HOUSING
5 NUT
6 STARTER SOLENOID
7 HOUSING BOLT
8 FRAME AND FIELD ASSEMBLY
KC0014-6D2-M-RS

Figure 31 Commutator End Cap Installation

12. Install the commutator end housing with the two mounting bolts.

Tighten

- Commutator end housing bolts to 6 N·m (4.5 lb.ft.).

STARTER SPECIFICATIONS

Manual Transmission Equipped Vehicles

No Load Test @ 11 volts

Amps - Minimum	35
Amps - Maximum	50

RPM at Drive Pinion

Minimum	1,200
Maximum	2,380

Automatic Transmission Equipped Vehicles

No Load Test @ 11.5 volts

Amps - Minimum	60
Amps - Maximum	90

RPM at Drive Pinion

Minimum	3,000
Maximum	5,950

TORQUE SPECIFICATIONS

Starter Assembly Mounting Bolts	23 N·m (17 lb.ft.)
Battery Cables	12 N·m (9 lb.ft.)
Starter Solenoid Mounting Nuts	7 N·m (5 lb.ft.)
Starter-to-Solenoid Wire Nut	10 N·m (7.5 lb.ft.)
Commutator End Housing Bolts	
Manual Transmission Equipped Vehicles	8 N·m (6 lb.ft.)
Automatic Transmission Equipped Vehicles	6 N·m (4.5 lb.ft.)

SPECIAL TOOLS

J 7872	Magnetic Base Indicator Set

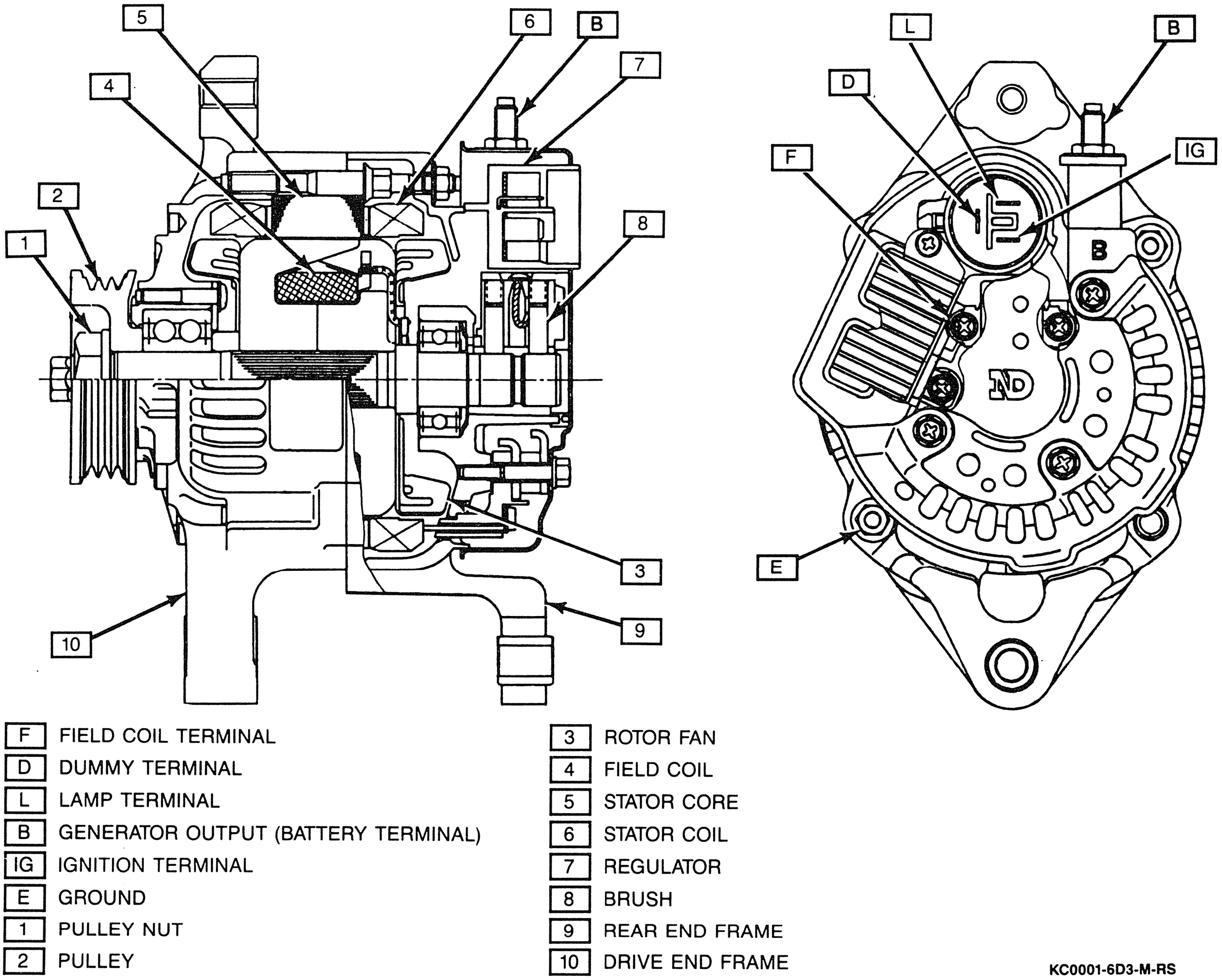
SECTION 6D3

CHARGING SYSTEM

CONTENTS

GENERAL DESCRIPTION 6D3-1
DIAGNOSIS 6D3-2
  Faulty Indicator Lamp Operation 6D3-2
  Undercharged Battery 6D3-4
  Overcharged Battery 6D3-5
  Voltage Regulator Test 6D3-5
  Generator Bench Check 6D3-5
  Noisy Generator 6D3- 6
ON-VEHICLE SERVICE 6D3- 6
  Generator 6D3- 6
UNIT REPAIR 6D3- 7
  Generator 6D3- 7
GENERATOR USAGE 6D3-11
TORQUE SPECIFICATIONS 6D3-11

GENERAL DESCRIPTION



F	FIELD COIL TERMINAL	3	ROTOR FAN
D	DUMMY TERMINAL	4	FIELD COIL
L	LAMP TERMINAL	5	STATOR CORE
B	GENERATOR OUTPUT (BATTERY TERMINAL)	6	STATOR COIL
IG	IGNITION TERMINAL	7	REGULATOR
E	GROUND	8	BRUSH
1	PULLEY NUT	9	REAR END FRAME
2	PULLEY	10	DRIVE END FRAME

KC0001-6D3-M-RS

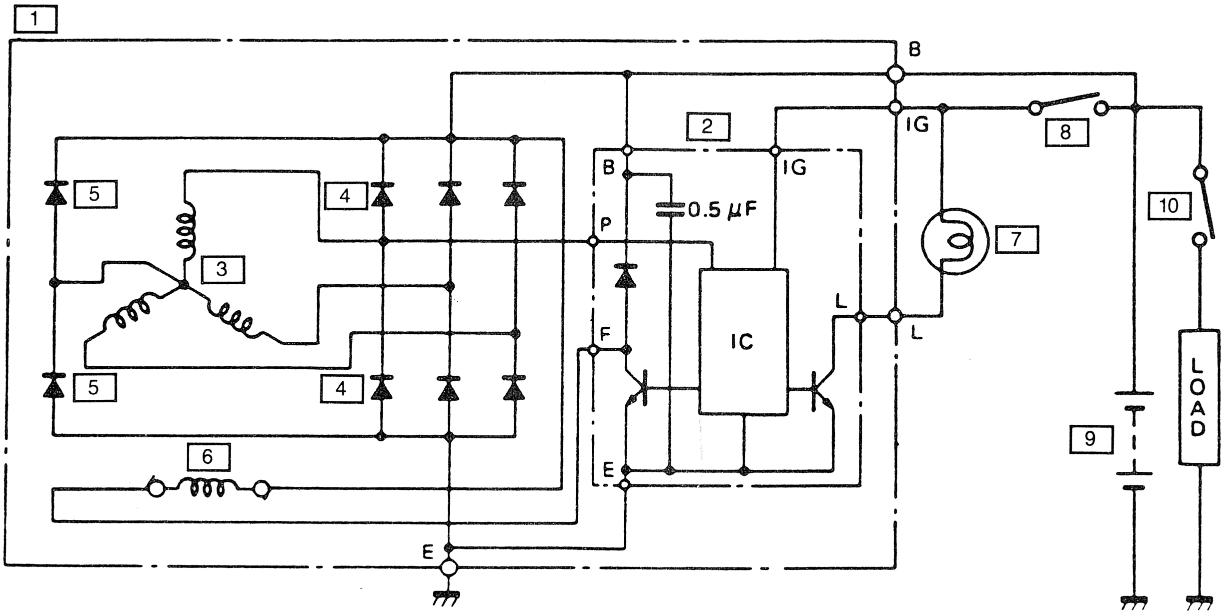
Figure 1 Generator/Regulator Assembly

This vehicle utilizes an integral regulator charging system. The I.C. (intergrated circuit) regulator is a soild state unit that is mounted inside the generator to the rear end frame. All regulator components are enclosed in a solid mold to protect them from the heat and corrosive elements. The regulator voltage cannot be adjusted.

The generator rotor bearings contain enough grease to eliminate the need for periodic lubrication. Two brushes carry current through two slip rings to the field coil mounted on the rotor. Under normal operating conditions, this arrangement is capable of providing long periods of attention-free service.

Stator windings are assembled inside a laminated core that forms part of the generator drive end frame. A rectifier bridge that contains six diodes is connected to the stator windings. These diodes electrically change stator AC voltage into DC voltage. This DC voltage is then transmitted to the generator output terminal.

Two neutral diodes are utilized to smooth out voltage fluctuations caused by varying generator speeds. A capacitor or condenser, mounted in the regulator, protects the rectifier bridge and neutral diodes. This condenser also suppresses radio noise.



1 GENERATOR/REGULATOR ASSEMBLY
2 I.C. REGULATOR
3 STATOR COIL
4 RECTIFIER BRIDGE
5 NEUTRAL POINT DIODE
6 FIELD COIL (ROTOR COIL)
7 CHARGE INDICATOR LIGHT
8 IGNITION SWITCH
9 BATTERY
10 LOAD SWITCH

KC0002-6D3-M-RS

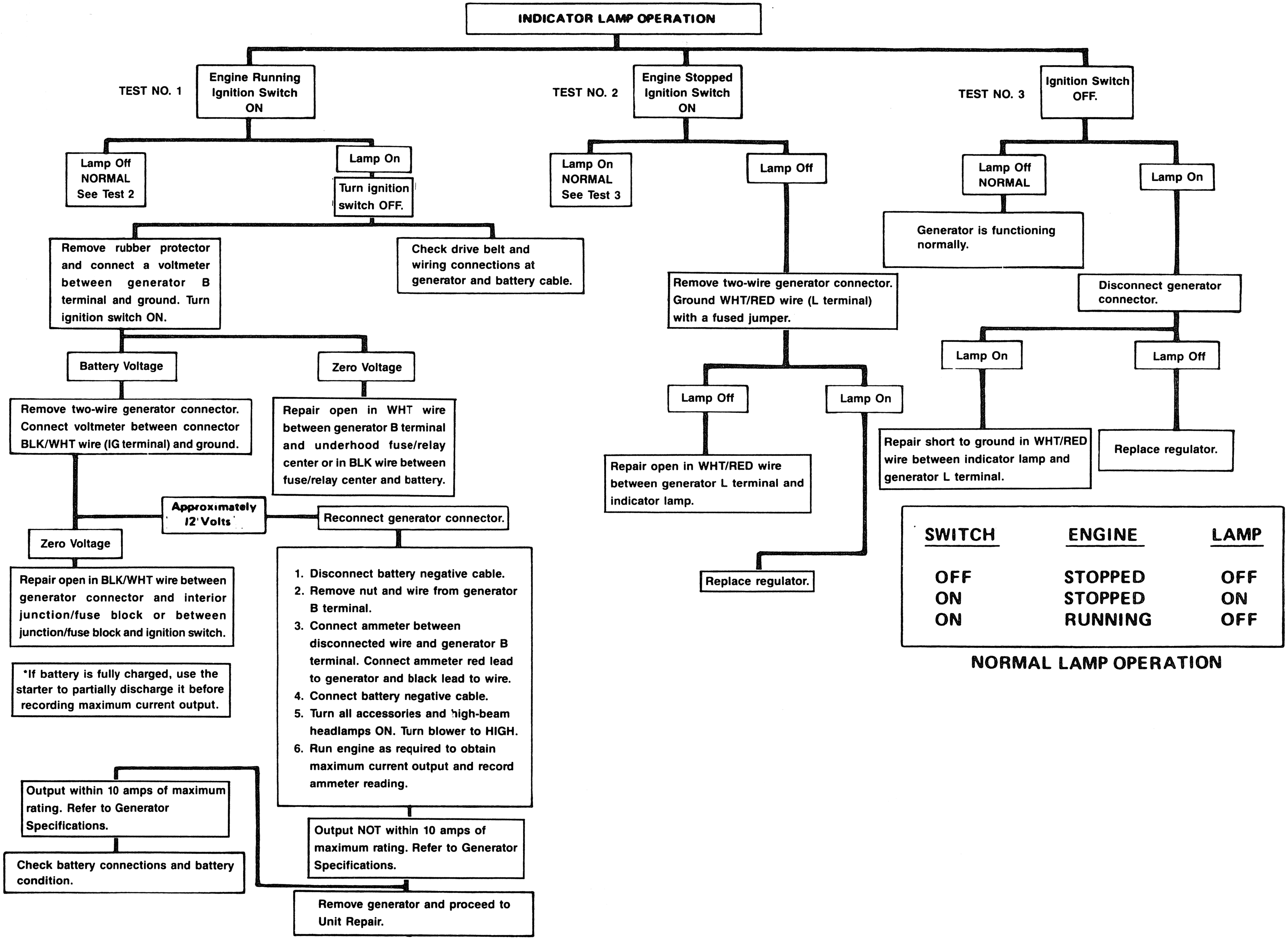
Figure 2 Charging Circuit

DIAGNOSIS

CAUTION: Never disconnect either battery terminal while the engine is running. Battery disconnection during engine operation will result in damage to electronic components.

FAULTY INDICATOR LAMP OPERATION

Check the indicator lamp for normal operation. If the indicator lamp operates normally, refer to "Undercharged Battey" in this section.


INDICATOR LAMP OPERATION
TEST NO. 1
Engine Running Ignition Switch ON
TEST NO. 2
Engine Stopped Ignition Switch ON
TEST NO. 3
Ignition Switch OFF.
Lamp Off NORMAL See Test 2
Lamp On
Lamp On NORMAL See Test 3
Lamp Off
Lamp Off NORMAL
Lamp On
Battery Voltage
Zero Voltage
Approximately 12 Volts*
Zero Voltage
Lamp On
Lamp Off
Lamp Off
Lamp On

Turn ignition switch OFF.

Remove rubber protector and connect a voltmeter between generator B terminal and ground. Turn ignition switch ON.

Check drive belt and wiring connections at generator and battery cable.

Remove two-wire generator connector. Connect voltmeter between connector BLK/WHT wire (IG terminal) and ground.

Repair open in WHT wire between generator B terminal and underhood fuse/relay center or in BLK wire between fuse/relay center and battery.

Reconnect generator connector.

Repair open in BLK/WHT wire between generator connector and interior junction/fuse block or between junction/fuse block and ignition switch.

*If battery is fully charged, use the starter to partially discharge it before recording maximum current output.

1. Disconnect battery negative cable.
2. Remove nut and wire from generator B terminal.
3. Connect ammeter between disconnected wire and generator B terminal. Connect ammeter red lead to generator and black lead to wire.
4. Connect battery negative cable.
5. Turn all accessories and high-beam headlamps ON. Turn blower to HIGH.
6. Run engine as required to obtain maximum current output and record ammeter reading.

Output within 10 amps of maximum rating. Refer to Generator Specifications.

Check battery connections and battery condition.

Output NOT within 10 amps of maximum rating. Refer to Generator Specifications.

Remove generator and proceed to Unit Repair.

Remove two-wire generator connector. Ground WHT/RED wire (L terminal) with a fused jumper.

Repair open in WHT/RED wire between generator L terminal and indicator lamp.

Replace regulator.

Generator is functioning normally.

Disconnect generator connector.

Repair short to ground in WHT/RED wire between indicator lamp and generator L terminal.

Replace regulator.

SWITCH	ENGINE	LAMP
OFF	STOPPED	OFF
ON	STOPPED	ON
ON	RUNNING	OFF

NORMAL LAMP OPERATION

KC0019-6D3-M-RS

Figure 3 Indicator Lamp Operation

UNDERCHARGED BATTERY

Figures 4 through 6

An undercharged battery is usually characterized by slow cranking or by a dark battery hydrometer. If this condition exists, check the following items for a cause:

1. Determine that the undercharged condition has not been caused by leaving accessories ON for extended periods without charging the battery.
2. Check the drive belt for proper tension. Refer to On-Vehicle Service "Generator" procedure in this section.
3. If a battery fault is suspected, refer to BATTERY (Section 6D1).
4. Inspect the wiring for faults. Check that all connections are clean and tight. Also check that any bulkhead connectors are tight and undamaged. Battery cable connections at battery, starter, and engine ground points should also be checked.
5. With all accessories turned OFF, connect a Voltmeter across the battery. Run the engine at a moderate speed and check the voltage. Some consideration should be given to the temperature to which the generator is exposed during this test. As the temperature of the regulator case in the generator increases, the voltage output will decrease (Figure 4). The standard setting for the voltage regulator is 14.2 - 14.8 colts at 25°C (77°F). Under normal conditions, therefore, operating voltage should always be at least 13.5 volts. If the voltage is 13.5 volts or more, proceed to Step 6. If the voltge is less than 13.5 volts, remove the generator. Refer to Unit Repair "Generator" procedure in this section.

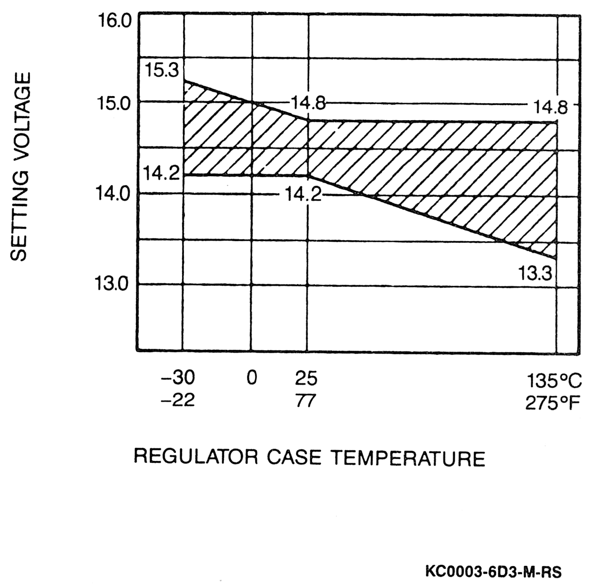


Figure 4 Regulator Setting Voltage - Voltage vs. Temperature

6. If Steps 1 through 5 have produced satisfactory results, perform the following generator test:

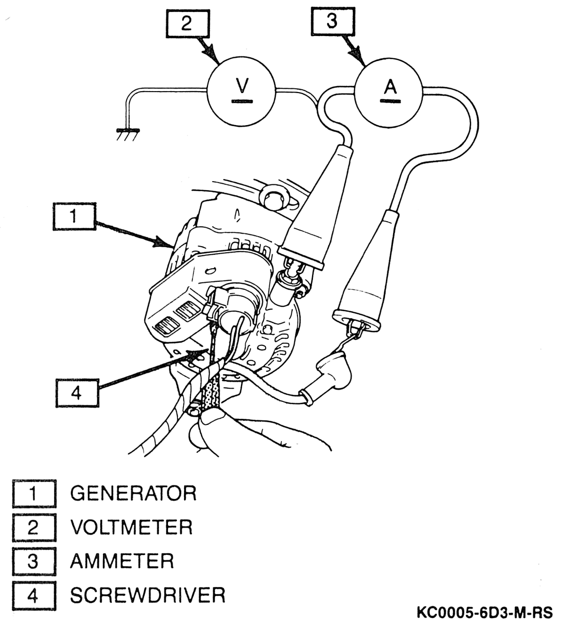


Figure 5 Ammeter/Voltmeter Connections

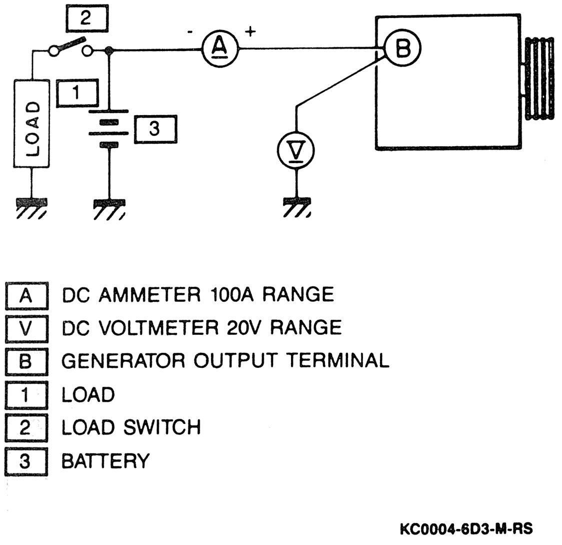


Figure 6 Ammeter/Voltmeter Connections - Schematic

a. Disconnect the battery negative cable.
b. Remove the rubber protector, nut, and the generator B terminal wire.
c. Connect an ammeter between the generator and the disconnected wire. Connect the ammeter black lead to the wire and the ammeter red lead to the generator.
d. Connect a voltmeter between the generator B terminal and chassis ground.
e. Start and run the engine at 2000 RPM. Turn all accessories and high-beam headlights ON. Turn the blower to HIGH. Ground the generator F terminal with a screwdriver.
f. Adjust engine speed, as required, to obtain the maximum current output.

g. If the current output is within 10 amperes of the maximum rating and the voltage reading is 13.5 - 16.0 volts, the generator is not faulty and is not the cause of an undercharged battery condition. Refer to "Generator Usage" in this section. If the current output is NOT within 10 amperes of the maximum rating or the voltage reading is less than 13.5 volts, remove the generator. Refer to On-Vehicle Service "Generator" procedure in this section.

OVERCHARGED BATTERY

1. To determine the battery's condition, refer to BATTERY (Section 6D1).
2. If an obvious overcharge condition exists, (as evidenced by the spewing of electrolyte), check the field windings for grounds and shorts. If the field winding is faulty, replace the rotor and retest the generator for proper voltage output. Refer to Unit Repair "Generator" procedure in this section.

VOLTAGE REGULATOR TEST

On-Vehicle

1. Connect a fast charger and voltmeter to the battery.
2. Turn the ignition switch to ON and slowly increase the charge rate. The indicator lamp in the vehicle will begin to dim when the voltage setting is reached. The indicator lamps should dim at 13.5 - 16.0 volts. If the test results are unsatisfactory, replace the voltage regulator. Refer to Unit Repair "Generator" procedure in this section.

Off-Vehicle

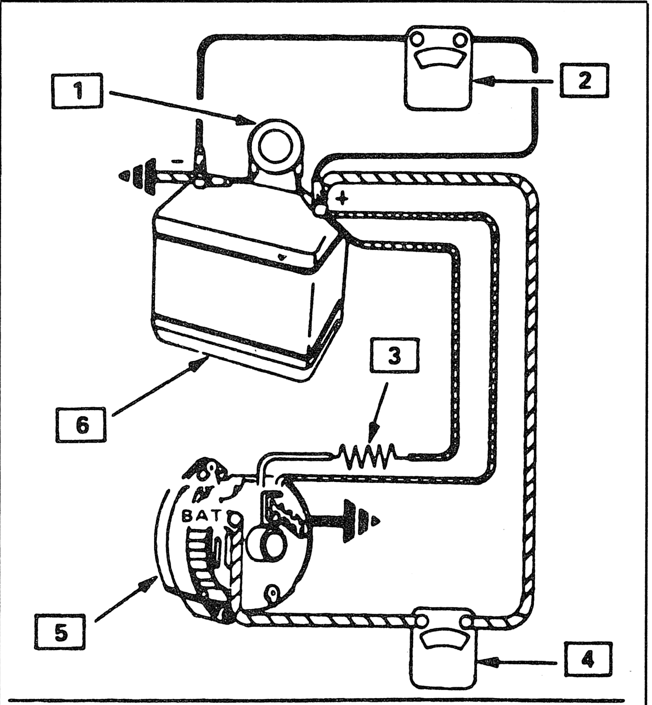
Figure 4

1. Remove the generator. Refer to On-Vehicle Service "Generator" procedure in this section.
2. Remove the voltage regulator from the generator. Refer to Unit Repair "Generator" procedure in this section.
3. Connect a voltmeter and a fast charger to a fully charged 12-volt battery.
4. Connect the voltage regulator battery terminal to the battery positive terminal.
5. Connect a non-powered test lamp across the voltage regulator rotor terminals. If the test lamp lights, proceed to Step 4. If the test lamp does not light, replace the voltage regulator. Refer to Unit Repair "Generator" procedure in this section.
6. Turn the fast charger ON. Observe the voltmeter. The test lamp will begin to dim as the voltage regulator voltage setting is reached. The test lamp should go out at 13.5 - 16.0 volts. If the test results are satisfactory, the voltage regulator is serviceable and should be reinstalled on the vehicle. If the test results are unsatisfactory, replace the voltage regulator. Refer to Unit Repair "Generator" procedure in this section.

The test lamp is connected into the circuit exactly as the rotor would be when the regulator is inside the generator. The regulator interrupts the current to the test lamp when the regulator voltage setting is reached. Again, this voltage will vary slightly with temperature variations (Figure 4).

GENERATOR BENCH CHECK

Figure 7



1—CARBON PILE
2—VOLTMETER
3—RESISTOR
4—TEST AMMETER
5—GENERATOR
6—BATTERY

520030-6D

Figure 7 Generator Bench Check Connections

To check the generator in a test stand, proceed as follows:

1. Remove the generator. Refer to On-Vehicl Service "Generator" procedure in this section.
2. Connect the generator to a fully charged 12-volt battery. Make the additional appropriate connections using a carbon pile, voltmeter, an ammeter, and 10-ohm resistor rated at six watts or more between the generator IG terminal and the battery.

NOTICE: The ground polarity of the generator and the battery must be the same.

3. Slowly increase generator speed and observe the voltage.
4. If the voltage is below 16 volts, proceed to Step 5. If the voltage is uncontrolled with speed and increases above 16 volts, test the voltage regulator. Refer to "Voltage Regulator Test" in

this section. Also check the field winding. Refer to Unit Repair "Generator" procedure in this section.

5. Operate the generator at a moderate speed and adjust the carbon pile, as required, to obtain the maximum current output. If the output is within 10 amperes of the specified rating, the generator is serviceable and can be installed on a vehicle. If the output is NOT within 10 amperes of the specified rating, proceed to Step 6. Refer to "Generator Usage" in this section.
6. Ground the generator F terminal.
7. Operate the generator at a moderate speed and adjust the carbon pile, as required, to obtain the maximum current output.
8. If the output is now within 10 amperes of the specified rating, test the voltage regulator. Refer to "Generator Usage" and "Voltage Regulator Test" in this section.
9. Check the field winding. Refer to Unit Repair "Generator" procedure in this section.
10. If the output is NOT within 10 amperes of the specified rating, check the field winding, the neutral diodes, the rectifier bridge, and the stator. Refer to the "Generator Usage" and Unit Repair "Generator" procedure in this section.

NOISY GENERATOR

Noise from a generator may be caused by a loose drive pulley, loose mounting bolts, worn or dirty bearings, faulty neutral diodes, or a defective stator. A high frequency whine (or magnetic noise) that is heard at full output is acceptable and should not be considered a generator failure.

ON-VEHICLE SERVICE

The generator does not require periodic lubrication. All bearing assemblies are permanently lubed. At periodic intervals, check the mounting bolts for tightness and adjust the belt tension.

GENERATOR

Figure 8

Remove or Disconnect

1. Battery negative cable at battery.

CAUTION: Failure to observe Step 1 may result in a serious personal injury. If a tool is shorted at the generator lead, the tool will become hot enough to cause a serious burn.

2. Rubber protector, nut, and wire from generator B terminal.
3. Drive belt adjuster arm.
4. Drive belt.
5. Mounting bolt and nut.
6. Generator.

Install or Connect

1. Generator with mounting bolt and nut.

Tighten

- Generator mounting bolt and nut to 23 N·m (17 lb.ft.).

2. Drive belt and adjuster arm.

Adjust

- Drive belt to obtain a 6-8 mm (0.24-0.31 in.) deflection with 10 kg (22 lb.) pressure exerted when reinstalling a used belt.

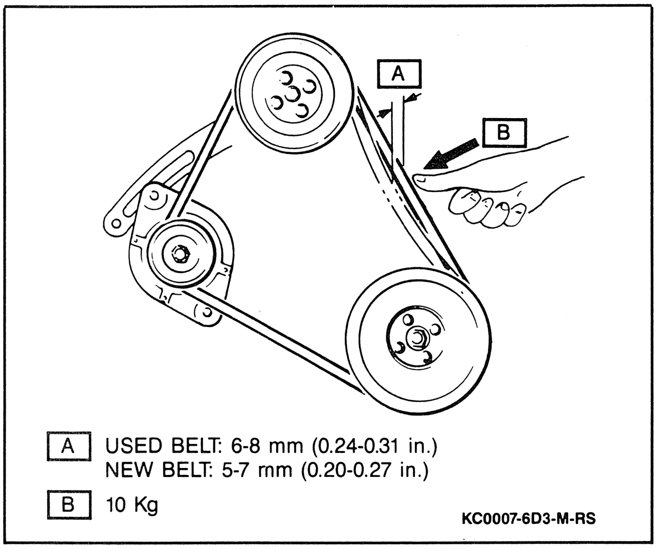

A
B
A USED BELT: 6-8 mm (0.24-0.31 in.)
NEW BELT: 5-7 mm (0.20-0.27 in.)
B 10 Kg
KC0007-6D3-M-RS

Figure 8 Drive Belt Tension

- Drive belt to obtain a 5-7 mm (0.20-0.27 in.) deflection with 10 kg (22 lb.) pressure exerted when installing a new belt.

Tighten

- Adjuster bolt to 23 N·m (17 lb.ft.).

3. Wire to generator B terminal, nut, and rubber protector.

Tighten

- Wire nut to 8 N·m (6 lb.ft.).

4. Battery negative cable to battery.

Tighten

- Cable to 12 N·m (9 lb.ft.).

UNIT REPAIR

GENERATOR

Figures 9 through 20

Disassemble

1. Hold the shaft with a hexagonal socket and remove the pulley nut with an offset box wrench. Remove the pulley.
2. Remove the generator B terminal nut and insulator.
3. Remove three screws and the rear end cover.
4. Remove two screws and the brush holder assembly.
5. Remove three screws and the voltage regulator.
6. Remove four screws, stretch the stator coil leads, and remove the rectifier.
7. Remove the rear end frame bolts and nuts.
8. Separate the rear end frame and the rotor from the drive end frame by tapping lightly on the rotor shaft with a plastic hammer.
9. Separate the rear end frame from the rotor by tapping the frame lightly with a plastic hammer.
10. Use a puller to remove the rear end bearing. Remove the bearing cover and wave breather.
11. Remove four screws and the retaining plate.
12. Drive out the drive end bearing.
13. Remove the stud bolts and the stator. (Heating the drive end frame may allow the stator to be removed more easily.)

Inspect

1. Check the insulation between the slip rings and the rotor core with an ohmmeter. If continuity exists, replace the rotor.
2. Check the resistance of the coil with an ohmmeter. With the ohmmeter probes on the generator slip rings, the resistance should be 2.8-3.0 ohms. If the resistance does not meet this specification, replace the rotor.
3. Check that all of the fan blades are in serviceable condition.
4. Check that all bearings are free from excessive wear, pitting, and corrosion.
5. Check the insulation between the stator coil and the rear end frame with an ohmmeter (Figure 17 - dotted probe). If continuity exists, replace the stator.
6. Check for continuity between stator neutral point A and each phase point B (Figure 17 - solid probe).
7. Using a ohmmeter adjusted to the 1000 ohm range, check for continuity between the recitifer B and E terminal. Swap the probes of the ohmmeter. The ohmmeter should measure continuity in one direction and infinity in the other direction. If the ohmmeter registers continuity or infinity in both directions, replace the regulator.
8. Check the condenser with a capacitance meter. The capacitance of the condenser should be 0.5 microfarads. If the capacitance differs from this specification by more than 0.03 microfarads, replace the condenser.
9. Check each brush for wear by measuring its length. Brush length should be 4.4-4.6 mm (0.17-0.18 in). If brush length does not meet this specification, replace the brush.

Assemble

1. Install the stator and the stud bolts.

Tighten

- Stud bolts to 8 N·m (6 lb.ft.).

2. Install the drive end bearing.
3. Install the bearing retainer with four screws.
4. Install the rear end bearing, bearing cover, and wave washer.
5. Install the rotor into the drive end frame and mate the drive end frame to the rear end frame with the frame bolts and nuts.

Tighten

- Frame bolts and nuts to 30 N·m (22 lb.ft.).

6. Install the rectifier with four screws.
7. Install the generator B terminal insulator and nut.

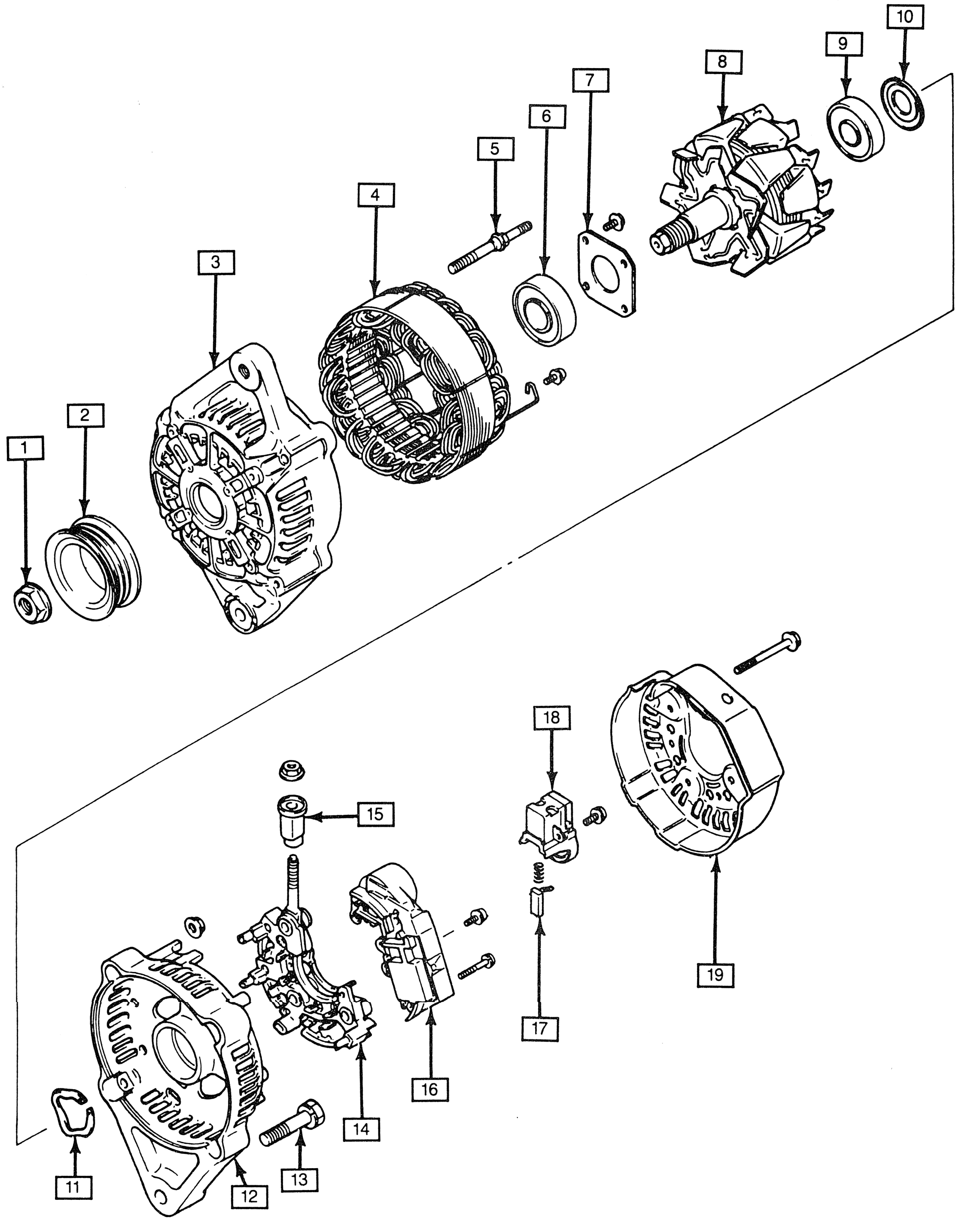
Tighten

- Generator B terminal nut to 5 N·m (3.7 lb. ft.).

8. Install the voltage regulator with three screws.
9. Install the brush holder assembly with two screws.
10. Install the rear end cover with three screws.
11. Install the pulley and pulley nut by holding the shaft with a hexagonal socket.

Tighten

- Pulley nut to 113 N·m (83 lb.ft.).



1	PULLEY NUT
2	PULLEY
3	DRIVE END FRAME
4	STATOR
5	STUD BOLT
6	DRIVE END BEARING
7	BEARING RETAINER
8	ROTOR
9	END HOUSING BEARING
10	BEARING COVER
11	WAVE WASHER
12	REAR END FRAME
13	FRAME BOLT
14	RECTIFIER
15	INSULATOR
16	REGULATOR
17	BRUSH
18	BRUSH HOLDER
19	REAR END COVER

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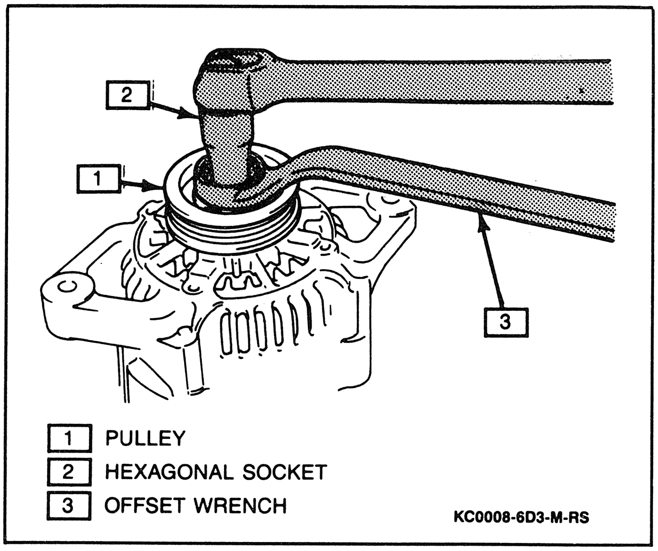
Figure 9 Generator Exploded View



1 PULLEY
2 HEXAGONAL SOCKET
3 OFFSET WRENCH

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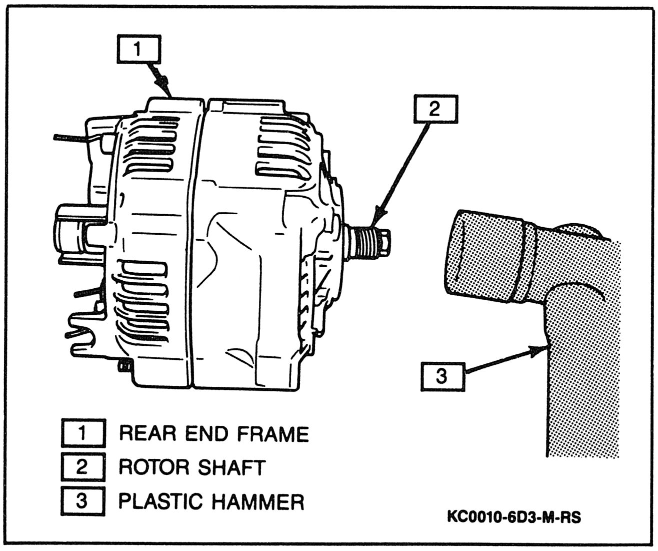
Figure 10 Pulley Removal



1 REAR END FRAME
2 ROTOR SHAFT
3 PLASTIC HAMMER

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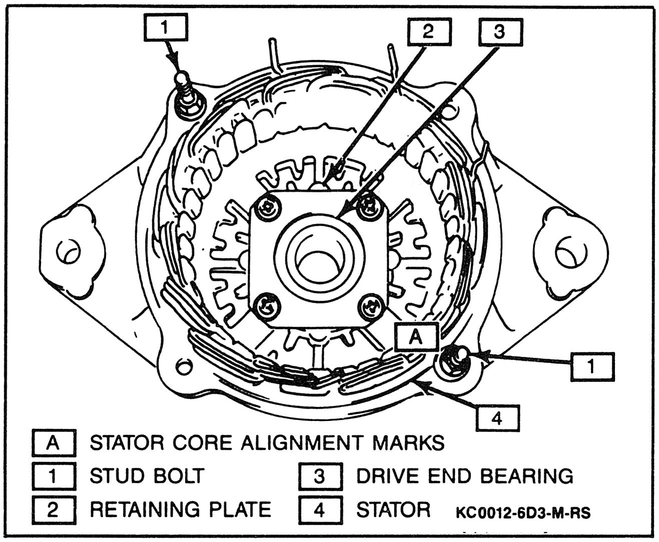
Figure 12 Rear End Frame and Rotor Removal



A STATOR CORE ALIGNMENT MARKS
1 STUD BOLT
2 RETAINING PLATE
3 DRIVE END BEARING
4 STATOR

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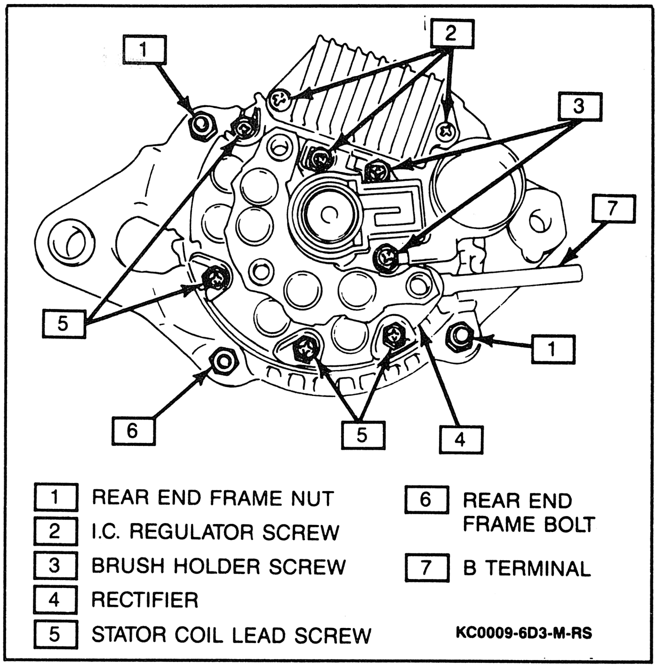
Figure 14 Drive End Bearing and Stator Removal



1 REAR END FRAME NUT
2 I.C. REGULATOR SCREW
3 BRUSH HOLDER SCREW
4 RECTIFIER
5 STATOR COIL LEAD SCREW
6 REAR END FRAME BOLT
7 B TERMINAL

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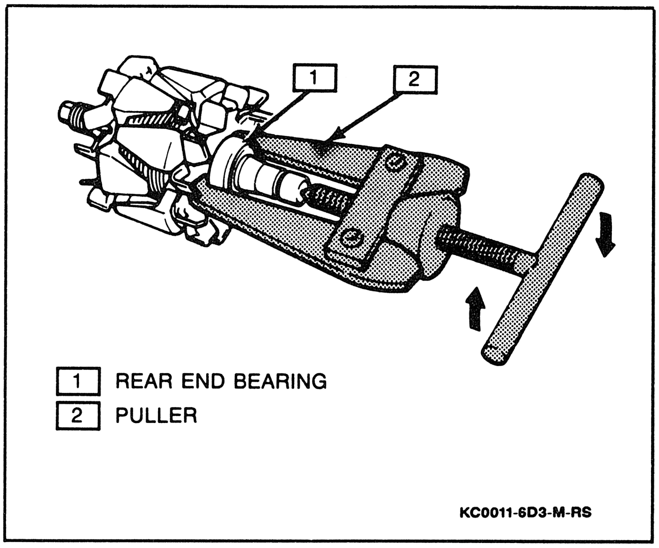
Figure 11 Generator Disassembly



1 REAR END BEARING
2 PULLER

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Figure 13 Rear End Bearing Removal

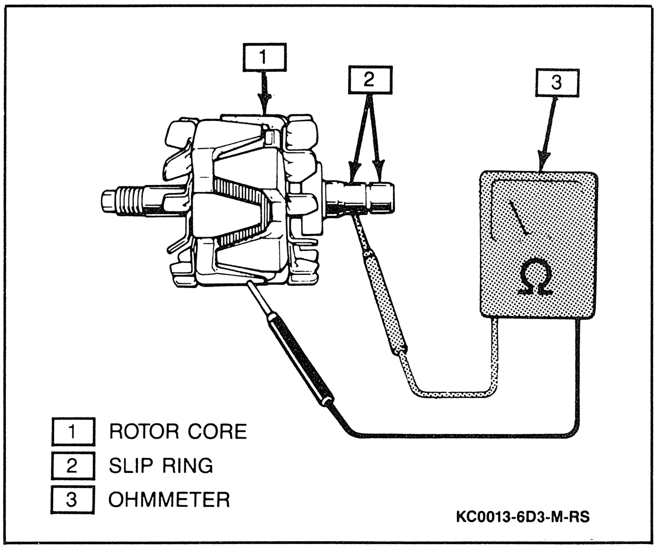
1
2
3
Ω
1 ROTOR CORE
2 SLIP RING
3 OHMMETER
KC0013-6D3-M-RS

Figure 15 Rotor Inspection - Slip Ring and Core Insulation

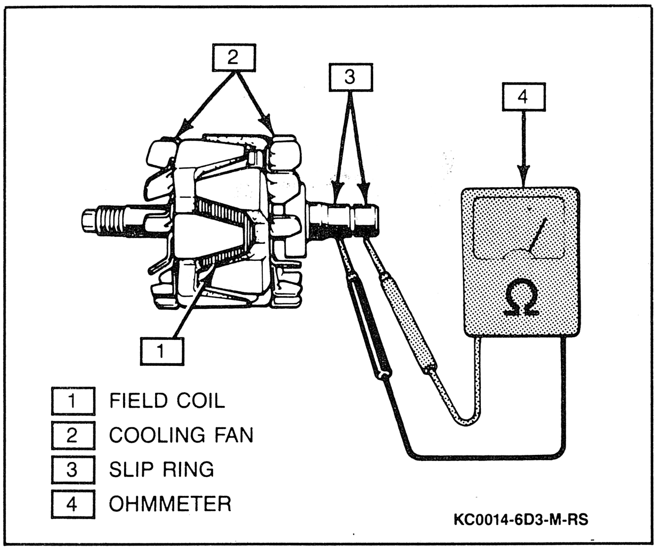
2
3
4
1
Ω
1 FIELD COIL
2 COOLING FAN
3 SLIP RING
4 OHMMETER
KC0014-6D3-M-RS

Figure 16 Rotor Inspection - Field Coil Resistance

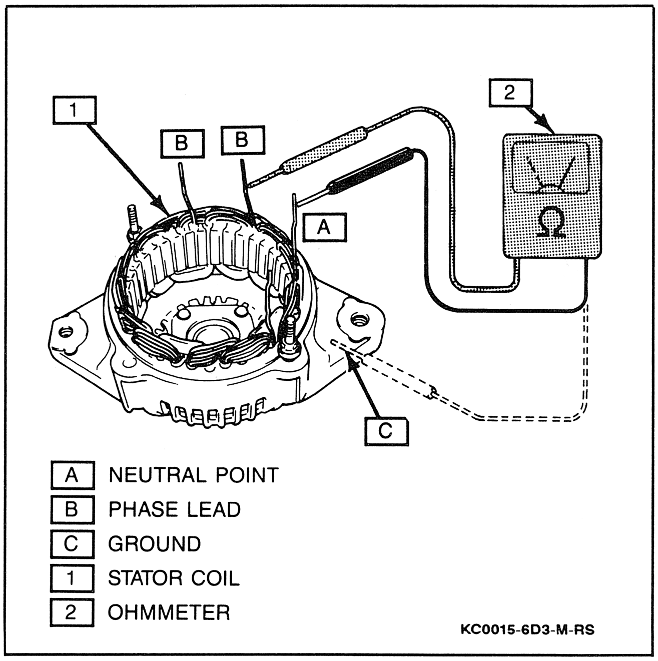
1
B
B
2
A
Ω
C
A NEUTRAL POINT
B PHASE LEAD
C GROUND
1 STATOR COIL
2 OHMMETER
KC0015-6D3-M-RS

Figure 17 Stator Inspection - Coil/Rear End Frame Insulation

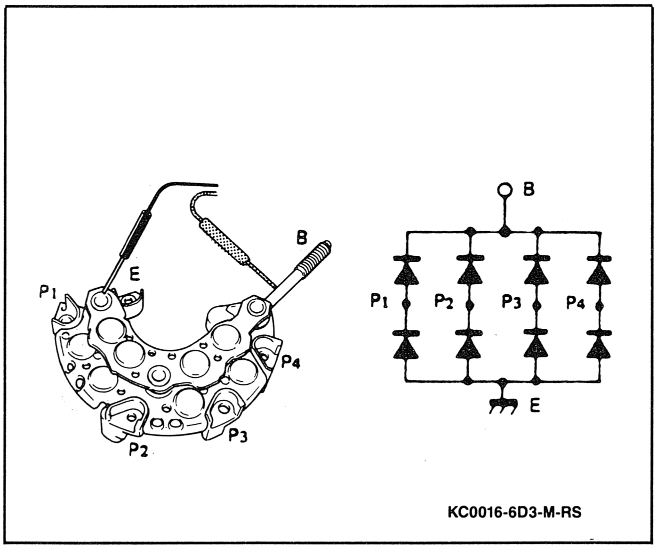
E
B
P1
P2
P3
P4
B
P1
P2
P3
P4
E
KC0016-6D3-M-RS

Figure 18 Rectifier Inspection - Continuity Test

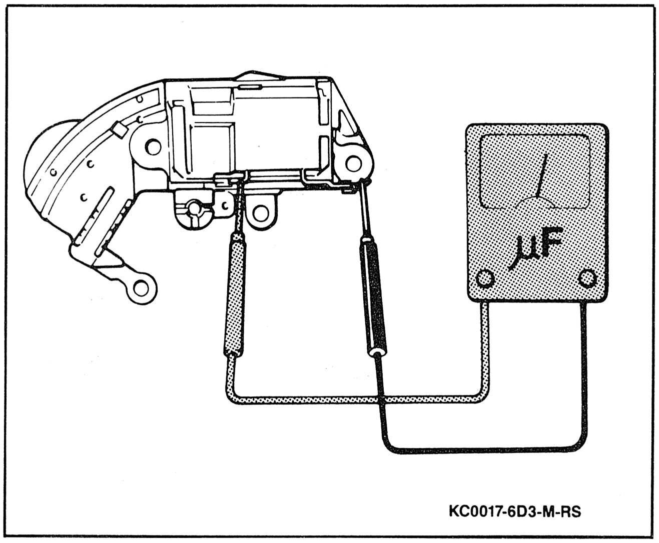
µF
KC0017-6D3-M-RS

Figure 19 Condenser Inspection - Capacitance Test

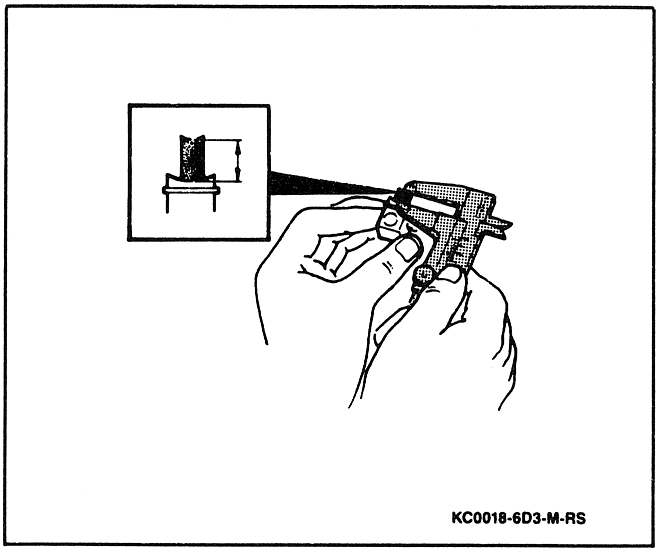

Figure 20 Brush Inspection - Brush Length Measurement

GENERATOR USAGE

Rated Output	50 AMPS
Voltage Regulator Voltage Setting	14.2-14.8 VOLTS @ 25°C (77°F)

TORQUE SPECIFICATIONS

Generator Mounting Bolts and Nuts	23 N·m (17 lb.ft.)
Adjuster Bolt	23 N·m (17 lb.ft.)
Wire Nut	8 N·m (6 lb.ft.)
Battery Negative Cable	12 N·m (9 lb.ft.)
Stud Bolt	8 N·m (6 lb.ft.)
Frame Bolts and Nuts	30 N·m (22 lb.ft.)
Generator B Terminal Nut	5 N·m (3.7 lb.ft.)
Pulley Nut	113 N·m (83 lb.ft.)

SECTION 6D4

IGNITION SYSTEM

CONTENTS

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  Electronic Spark Control Ignition System 6D4-1
  Ignition Timing 6D4-1
  Secondary Wiring 6D4-1
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  Spark Plugs 6D4-4
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GENERAL DESCRIPTION

The ignition circuit consists of the battery, the distributor, the ignition switch, the spark plugs, and primary and secondary wiring. Two types of ignition systems are utilized depending upon vehicle application. The Metro LSi utilizes a conventional solid state ignition system with vacuum/centrifugal spark control. The Metro model utilizes an electronic spark control system which is monitored and controlled by the Electronic (Engine) Control Module (ECM).

CONVENTIONAL VACUUM/CENTRIFUGAL SPARK CONTROL SYSTEM

Figure 1

The basic components of this ignition system are the ignition coil, the distributor, and the spark plugs and spark plug wiring. The distributor consists of a signal generator (signal rotor and pickup coil), ignitor, rotor, vacuum advancer, and centrifugal advancer.

When the distributor shaft rotates, a fluctuating magnetic field is generated due to changes in the air gap between the pickup coil and signal rotor. As a result, an alternating current (AC) voltage is induced in the pickup coil. This induced AC voltage peaks when a ridge on the signal rotor is adjacent to the ridge on the pickup coil. When the voltage peaks, the ignitor breaks the circuit to ground from the negative (-) side of the coil primary winding. With the circuit broken, the magnetic field in the ignition coil, which has been generated by the electrical current passing through it, collapses. The high voltage induced by the collapsing field is then forced to find a ground through the secondary coil wire, the distributor cap, the rotor, the spark plug wire, and finally across the spark plug air gap to the engine block.

Spark timing is mechanically controlled by a vacuum advance system which uses engine manifold vacuum and a centrifugal advance mechanism.

ELECTRONIC SPARK CONTROL IGNITION SYSTEM

Figure 2

All spark timing changes in the distributor are performed electronically by the Electronic (Engine) Control Module (ECM). The ECM monitors information from various engine sensors, computes the desired spark timing, and signals the distributor to change the timing accordingly. No vacuum or mechanical advance mechanisms are used. For further information on this system, refer to DRIVEABILITY AND EMISSIONS (Section 6E).

IGNITION TIMING

Timing specifications for each engine are listed on the Vehicle Emissions Control Information label located under the hood. When using a timing light, connect an adapter between the spark plug and the spark plug wire or use an inductive-type pickup. **Do not pierce the plug lead.** Once the insulation of the spark plug wire has been broken, current will jump to the nearest ground and the spark plug will not fire properly. **Always follow the label procedures when adjusting timing.** Refer to the On-Vehicle Service "Ignition Timing" procedure later in this section.

SECONDARY WIRING

The spark plug wiring used with the ignition system withstands very high temperatures and also provides an excellent insulator for the high voltages produced by both the vacuum/centrifugal and the electronic spark control ignition systems. The spark plug boot forms a tight seal on the spark plug and **the boot should be twisted one-half turn before**

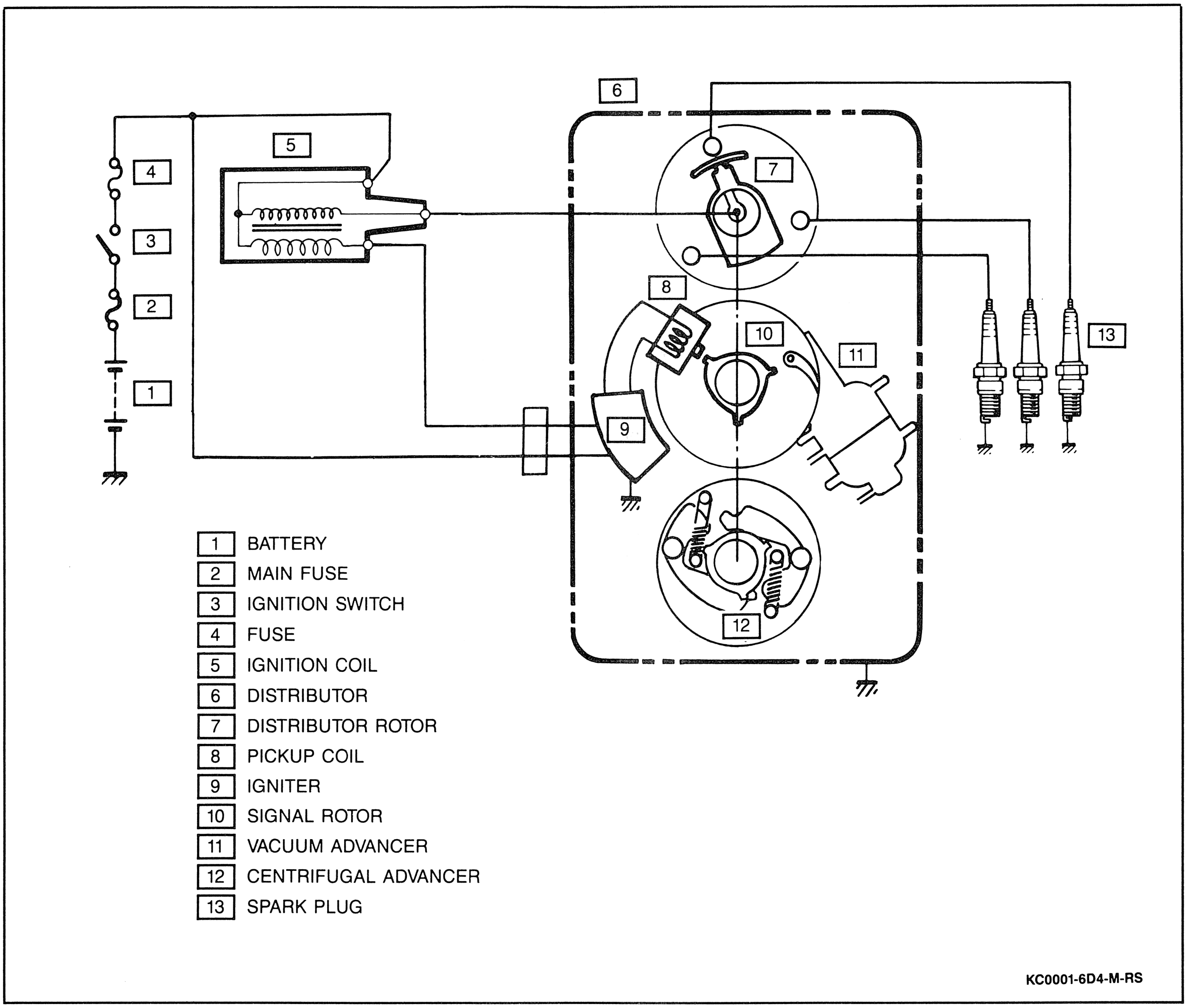

6
5
7
4
3
8
10
11
2
13
1
9
12
1 BATTERY
2 MAIN FUSE
3 IGNITION SWITCH
4 FUSE
5 IGNITION COIL
6 DISTRIBUTOR
7 DISTRIBUTOR ROTOR
8 PICKUP COIL
9 IGNITER
10 SIGNAL ROTOR
11 VACUUM ADVANCER
12 CENTRIFUGAL ADVANCER
13 SPARK PLUG
KC0001-6D4-M-RS

Figure 1 Conventional Ignition System

removing. Care should also be exercised when using a timing light or other pickup equipment. Do not force anything between the boot and the wiring. Connections should be made in parallel using an adapter. **Do not pull on the wire to be removed.** Pull on the boot or use a tool designed for this purpose.

SPARK PLUGS

Figure 3

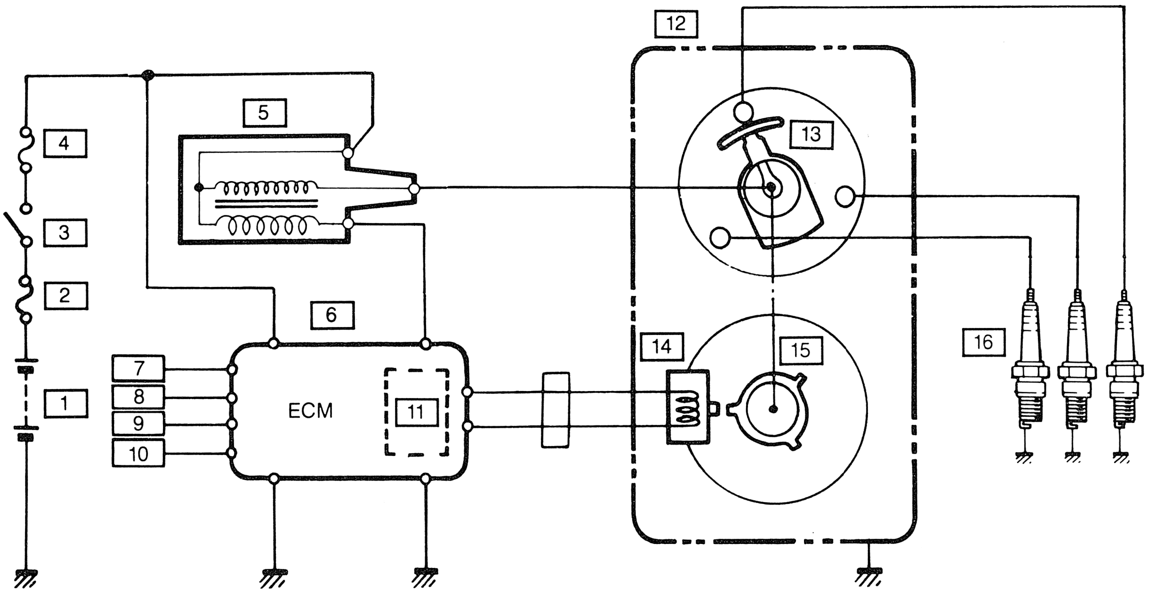
For spark plug type and gap sizes, refer to MAINTENANCE AND LUBRICATION (Section 0B). Always replace spark plugs with the correct type listed.

Normal service is assumed to be a mixture of idling, slow-speed, and high-speed driving. Occasional or intermittent highway driving is needed for good spark plug performance. The higher combustion temperatures generated during highway driving burn away any deposits of carbon or oxides that have built up from frequent idling or continual stop-and-go driving.

Spark plugs must operate within certain temperature limits if they are to provide the performance and service life expected. The spark plug selected for an engine is based on the normal service for which the engine was designed. The spark plug may not perform satisfactorily under other-than-normal operating conditions. For almost exclusive city driving, a spark plug 1 step higher in heat range might deliver longer service life than the spark plug recommended for normal operation. Conversely, a spark plug 1 step colder will perform better for heavy loads or continual high-speed driving.

Three rules to follow in selecting spark plugs for an engine in good condition are:

1. Select a spark plug with the specified heat range.
2. Should spark plug overheating occur, select a spark plug that is 1 heat range lower than the specified heat range.
3. If fouling is a problem, select a spark plug that is 1 heat range higher than the specified heat range.



1	BATTERY
2	MAIN FUSE
3	IGNITION SWITCH
4	FUSE
5	IGNITION COIL
6	ECM
7	INTAKE VACUUM SIGNAL (PRESSURE SENSOR)
8	IDLE SWITCH (THROTTLE BODY)
9	COOLANT TEMPERATURE (WATER TEMPERATURE SENSOR)
10	DIAGNOSTIC CONNECTOR
11	IGNITER
12	DISTRIBUTOR
13	DISTRIBUTOR ROTOR
14	PICKUP COIL
15	SIGNAL ROTOR
16	SPARK PLUG

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Figure 2 Electronic Spark Control Ignition System

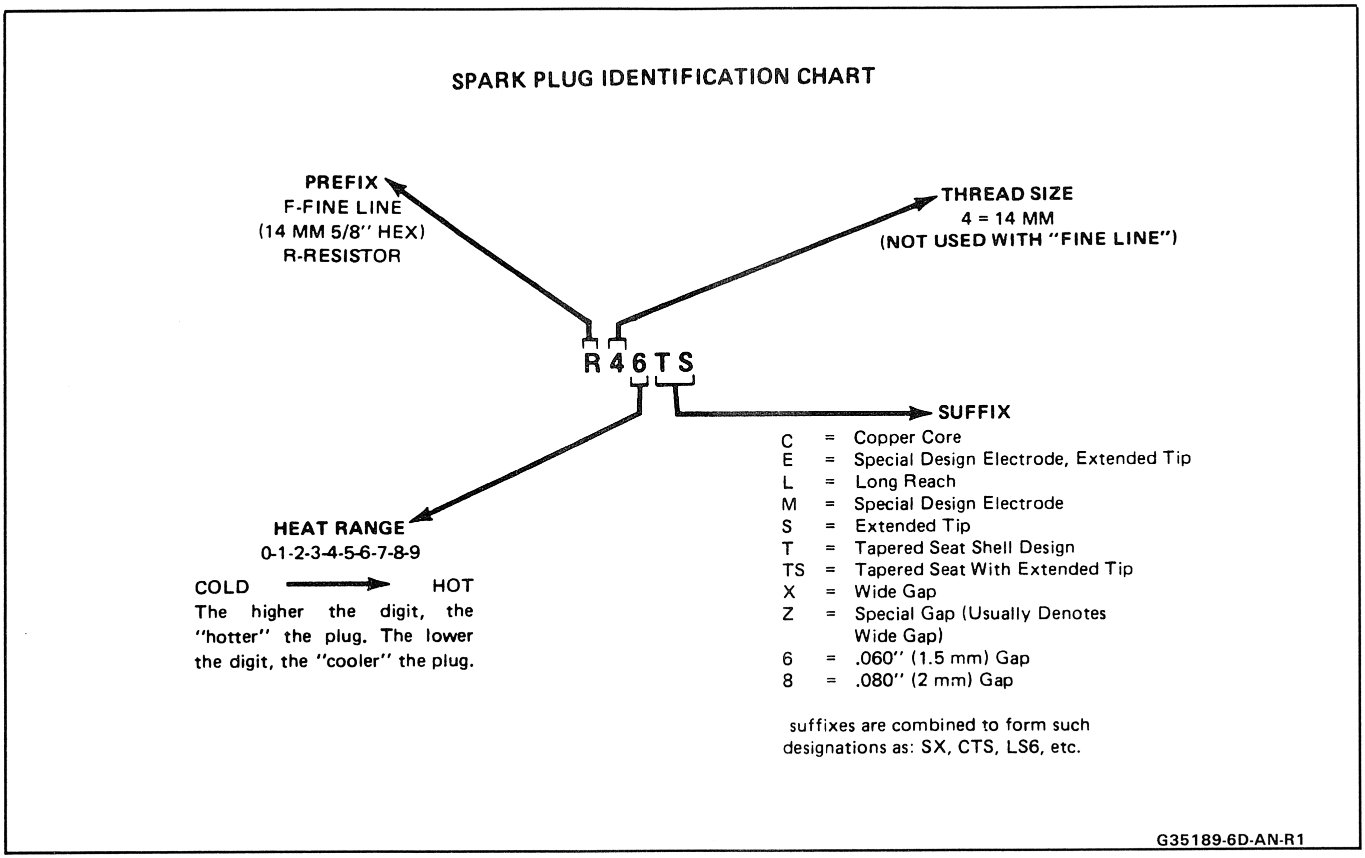

SPARK PLUG IDENTIFICATION CHART
PREFIX
F-FINE LINE
(14 MM 5/8" HEX)
R-RESISTOR
THREAD SIZE
4 = 14 MM
(NOT USED WITH "FINE LINE")
R 4 6 T S
SUFFIX
C = Copper Core
E = Special Design Electrode, Extended Tip
L = Long Reach
M = Special Design Electrode
S = Extended Tip
T = Tapered Seat Shell Design
TS = Tapered Seat With Extended Tip
X = Wide Gap
Z = Special Gap (Usually Denotes Wide Gap)
6 = .060" (1.5 mm) Gap
8 = .080" (2 mm) Gap
suffixes are combined to form such designations as: SX, CTS, LS6, etc.
HEAT RANGE
0-1-2-3-4-5-6-7-8-9
COLD
HOT
The higher the digit, the "hotter" the plug. The lower the digit, the "cooler" the plug.
G35189-6D-AN-R1

Figure 3 Spark Plug Identification Chart

DIAGNOSIS

SPARK PLUGS

Figure 4

Worn or dirty spark plugs may provide satisfactory performance at idling speed but, under more demanding operating conditions, they will frequently misfire. Misfiring spark plugs should be suspected from a number of symptons. These symptoms include: poor fuel economy, power loss, loss of speed, hard starting and generally poor engine performance. Spark plugs may misfire due to carbon fouling, an excessive air gap, a broken insulator, bridged electrodes, or a damaged spark plug wire and/or boot.

Fouled spark plugs are indicated by black carbon deposits on the electrodes. These black deposits are usually the result of slow-speed driving and short runs in which sufficient engine operating temperature is seldom achieved. Worn pistons, rings, faulty ignition, over-rich air/fuel mixture, and the incorrect spark plug heat range will also result in carbon deposits.

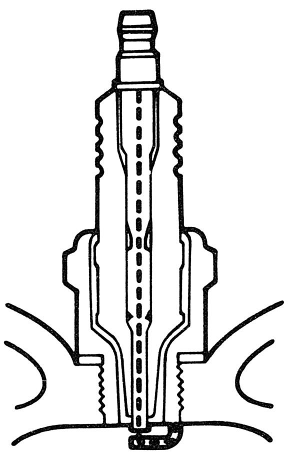
Carbon deposits on the spark plug insulator tip may become conductive and cause the high voltage arc to track along the tip to some point where it arcs to join the spark plug shell. This arc then ignites the air/fuel mixture later than normal which, in effect, retards the ignition timing. Heavy carbon deposits may be conductive to the extent that the arc path now becomes a shunt path to the spark plug shell. This condition prevents the high voltage from arcing and igniting the air/fuel mixture. Once arc tracking occurs, the spark plug may be permanently damaged and must be replace.

Excessive electrode wear, on low-mileage spark plugs, usually indicates that the engine is operating at speeds consistently higher than those for which the engine was designed or that the spark plug's heat range is too high. Electrode wear may also be the result of spark plug overheating caused by combustion gases leaking past the threads. Electrode wear can become excessive to the point that the high voltage no longer arcs across the electrodes.

Broken or cracked insulators are usually the result of improper installation. Broken upper insulators usually result from a poor-fitting wrench or an outside blow. Although the cracked insulator may not be evident immediately, oil or moisture will soon penetrate the crack. The crack will then cause the high voltage to ground or arc through the insulator to the spark plug shell.

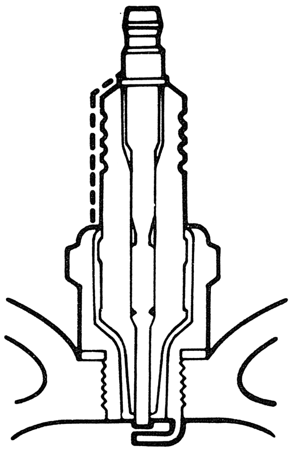
Broken lower insulators often result from improper gapping and are usually visible immediately. When gapping a spark plug, always make the gap adjustment by bending the ground (side) electrode. Spark plugs with broken insulators must always be replaced.

Damaged spark plug wires and/or boots cause a similar condition to that of a cracked insulator. The high voltage arc flashes through the wire or boot and grounds on the spark plug shell or the engine.

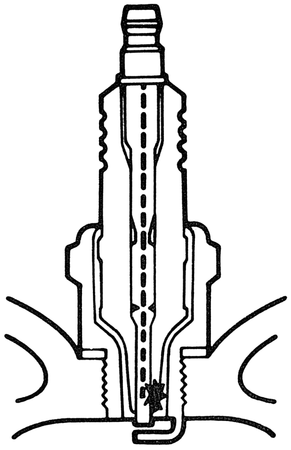


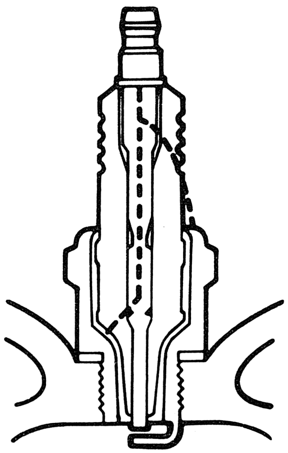
Bridged Electrodes
Fouling deposits between the electrodes "ground out" the high voltage needed to fire the spark plug. The arc between the electrodes does not occur and the fuel air mixture is not ignited. This causes a power loss and exhausting of raw fuel.

Flashover
A damaged spark plug boot, along with dirt and moisture, could permit the high voltage charge to short over the insulator to the spark plug shell or the engine. AC's buttress insulator design helps prevent high voltage flashover.



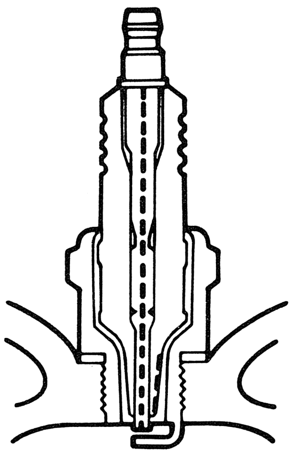
Tracking Arc
High voltage arcs between a fouling deposit on the insulator tip and spark plug shell. This ignites the fuel/air mixture at some point along the insulator tip, retarding the ignition timing which causes a power and fuel loss.





Cracked Insulator
A crack in the spark plug insulator could cause the high voltage charge to "ground out." Here, the spark does not jump the electrode gap and the fuel air mixture is not ignited. This causes a power loss and raw fuel is exhausted.

Fouled Spark Plug
Deposits that have formed on the insulator tip may become conductive and provide a "shunt" path to the shell. This prevents the high voltage from arcing between the electrodes. A power and fuel loss is the result.



Wide Gap
Spark plug electrodes are worn so that the high voltage charge cannot arc across the electrodes. Improper gapping of electrodes on new or "cleaned" spark plugs could cause a similar condition. Fuel remains unburned and a power loss results.

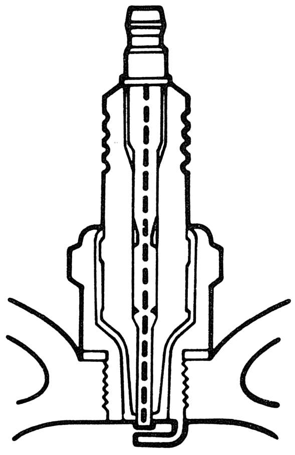


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Figure 4 Spark Plug Diagnosis

Spark plugs are protected by an insulating boot comprised of heat-resistant material which covers the spark plug terminal and extends downward over a portion of the spark plug insulator. These boots prevent the flash-over that causes engine misfiring.

Do not mistake corona discharge for flash-over or a shorted insulator. Corona discharge is a steady blue light appearing around the insulator, just above the shell crimp. It is the visible evidence of a high-tension field and has no effect on ignition system performance. This discharge may repel dust particles and leave a clear ring on the insulator just above the shell. This ring is sometimes mistaken as evidence that combustion gases have blown out between the shell and the insulator.

GENERAL IGNITION SYSTEM DIAGNOSIS

The following procedure should be followed if the vehicle cranks but does not start:

1. Check for spark at each spark plug with a spark tester.
   - If no spark is detected, proceed to Step 2.
   - If spark is only detected on some spark plugs, check for a faulty distributor cap or rotor. Also check the spark plugs and the spark plug wires. Replace as needed.
2. Check for voltage at the ignition coil positive (+) terminal with a voltmeter.
   - If battery voltage is detected, proceed to Step 3.
   - If battery voltage is not detected, repair the open in the wiring between the battery and the ignition coil.
3. Check ignition coil resistance. Refer to the On-Vehicle Service "Ignition Coil" procedure later in this section.
   - If ignition coil resistance is within specification, proceed to Step 4.
   - If ignition coil resistance is not within specification, replace the ignition coil.
4. Check noise filter and condenser. Refer to item "NOISE FILTER AND CONDENSER" on page 6D4-8.
   - If both noise filter and condenser are in good condition, proceed to step 5.
   - If resistance is not about 2.2 kΩ or each condenser is conductive, replace noise filter or condenser.
5. **Conventional Vacuum/Centrifugal Spark Control Ignition Systems Only**
   Check the continuity of the BRN/WHT wire between the ignition coil negative (-) terminal and the distributor.
   - If continuity exists, replace the pickup coil and the igniter. Refer to the "Conventional Vacuum/Centrifugal Spark Control Distributor" procedure later in this section.
   - If continuity does not exist, repair the open in the BRN/WHT wire.
6. **Electronic Spark Control Ignition Systems Only** Check the BRN/WHT wire between the distributor and the ECM.
   - If continuity exists, replace the generator assembly within the distributor. Refer to the "Electronic Spark Control Distributor" procedure later in this section. If the vehicle does not start after replacing the generator assembly, replace the ECM. Refer to DRIVEABILITY AND EMISSIONS (Section 6E).
   - If continuity does not exist, repair the open in the BRN/WHT wire between the distributor and the ECM.

ON-VEHICLE SERVICE

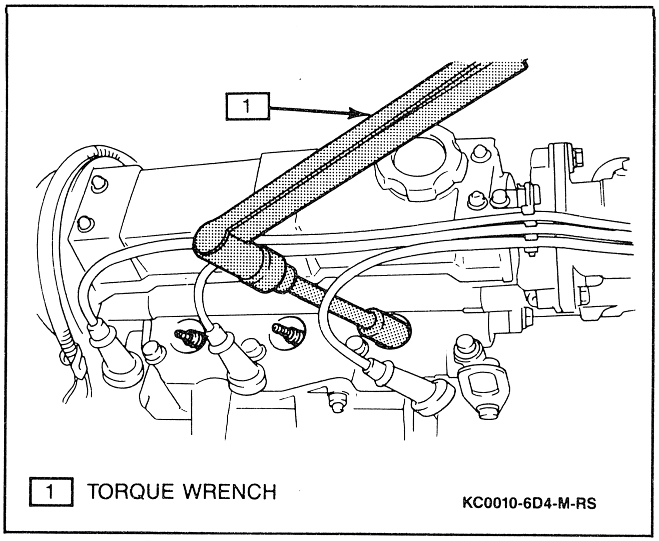


Figure 5 Installing Spark Plugs

SPARK PLUGS

Figure 5

Remove or Disconnect

1. Spark plug wire from spark plug by gripping the spark plug boot firmly. Turn the spark plug boot one-half turn while removing the spark plug wire.
2. Spark plug.

Inspect

- Spark plugs for electrode wear, carbon deposits, and insulator damage. Refer to "Spark Plugs" under Diagnosis earlier in this section.

Install or Connect

Important

- Always use a spark plug type that is specified for this vehicle. For replacement spark plug specifications, refer to MAINTENANCE AND LUBRICATION (Section 0B).

Adjust

- Spark plug gap to 1.0 - 1.1mm (0.039 - 0.043 in.).

1. Spark plug.

Tighten

- Spark plug to 28 N·m (21 lb.ft.).

2. Spark plug wire by pressing the spark plug boot onto the spark plug.

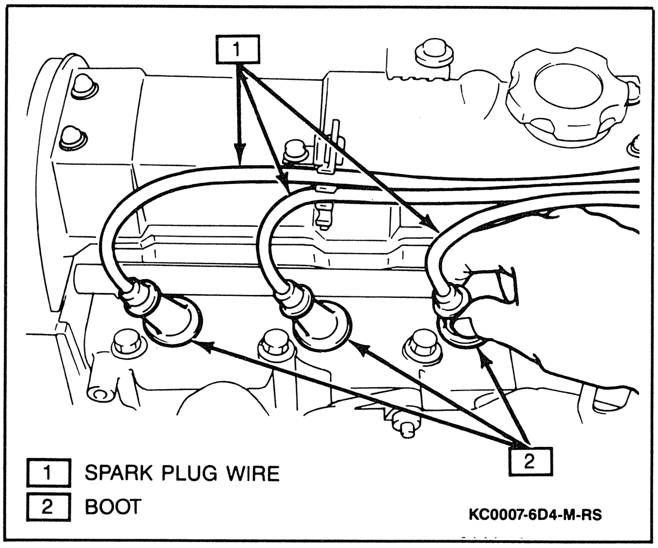


Figure 6 Removing Spark Plug Wires

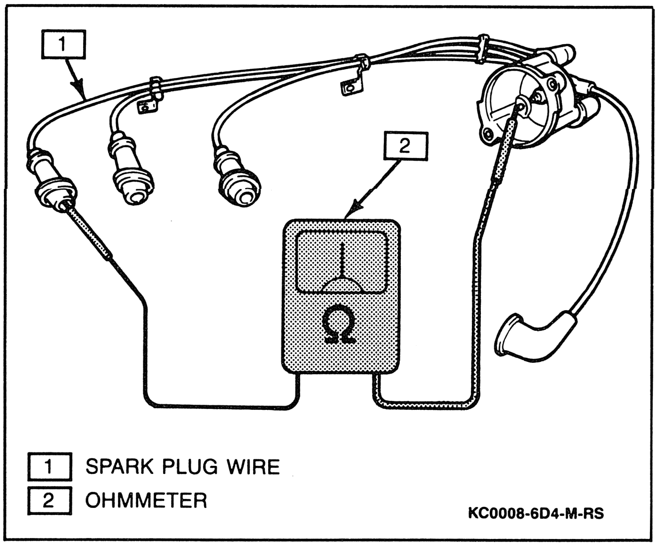


Figure 7 Measuring Spark Plug/Coil Wire Resistance

SPARK PLUG AND COIL WIRES

Figures 6 and 7

Remove or Disconnect

1. Coil wire from the coil by gripping the boot firmly. Turn the boot one-half turn while removing the wire.
2. Spark plug wire clamp bolts.
3. Spark plug wires from the spark plug by gripping the spark plug boots firmly. Turn the spark plug boots one-half turn while removing the spark plug wires.
4. Distributor cap by loosening the two screws.

Inspect

- Distributor cap for carbon tracking, arcing, or cracks. Replace as needed.

Measure

- Resistance of each spark plug wire and the coil wire with an ohmmeter. If the resistance is not 10 - 22 kΩ/meter (3 - 6.5 kΩ/foot), replace the wire.

Install or Connect

1. Distributor cap by tightening the two screws.
2. Spark plug wires by pressing the spark plug boots firmly onto the spark plugs.
3. Spark plug wire clamp bolts.
4. Coil wire by pressing the coil boot firmly onto coil.

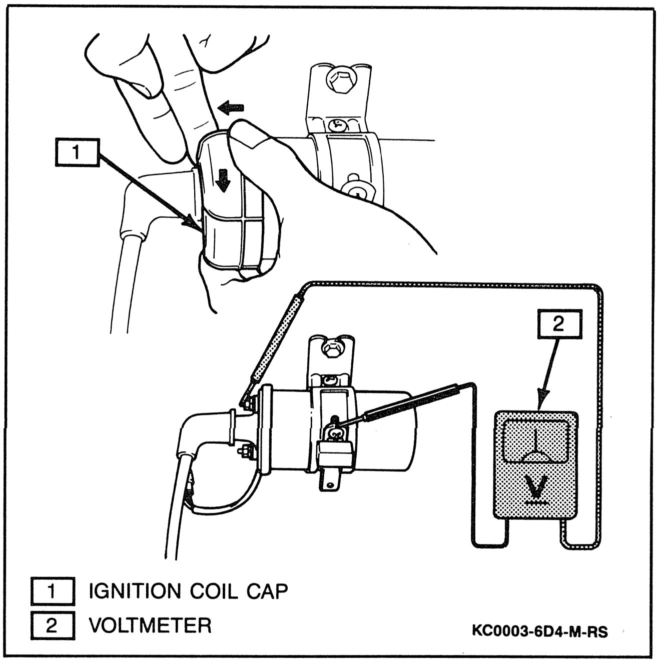


Figure 8 Measuring Ignition Coil Voltage

IGNITION COIL

Figures 8 and 9

Measure

- Remove the ignition coil cap.
- Voltage at the ignition coil positive (+) terminal with a voltmeter. If battery voltage is not detected, check the engine wiring harness and the ignition coil connector. Also check the underhood fuse/relay center for blown fuses.

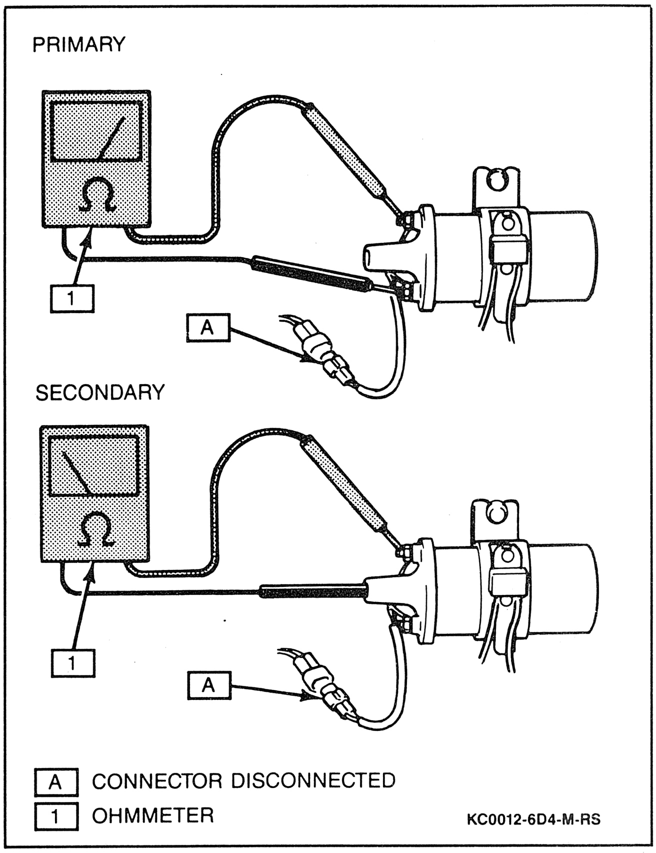

PRIMARY
Ω
1
A
SECONDARY
Ω
1
A
A CONNECTOR DISCONNECTED
1 OHMMETER
KC0012-6D4-M-RS

Figure 9 Measuring Ignition Coil Resistance

Remove or Disconnect

1. Battery negative (-) cable.
2. Coil wire from the coil by gripping the boot firmly. Turn the boot one-half turn while removing the coil wire.
3. Ignition coil electrical connector.
4. Ignition coil by loosening the clamp screw.

Measure

- Resistance of the secondary coil winding with an ohmmeter. If the resistance is not 1.33 - 1.55 ohms, replace the ignition coil.
- Resistance of the secondary coil winding with an ohmmeter. If the resistance is not 10,700 - 14.500 ohms, replace the coil.

Install or Connect

1. Ignition coil into the clamp and tighten the clamp screw.
2. Ignition coil electrical connector.
3. Coil wire by pressing the boot on firmly.
4. Battery negative (-) cable.

Tighten

- Battery cable to 12 N·m (108 lb.in.).

NOISE FILTER AND CONDENSER

Figure 10

The noise filter and condenser are mainly used for radio noise suppression and will seldom require replacement.

Remove or Disconnect

1. Noise filter and condenser connectors.
2. Noise filter and condenser.

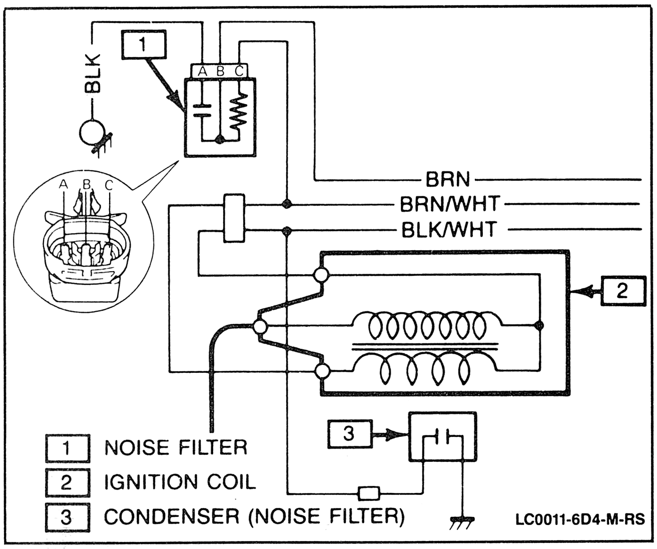

BLK
1
A B C
A B C
BRN
BRN/WHT
BLK/WHT
2
3
1 NOISE FILTER
2 IGNITION COIL
3 CONDENSER (NOISE FILTER)
LC0011-6D4-M-RS

Figure 10 Noise Suppression Circuitry

Measure

- Resistance between B and C terminal of noise filter, and continuity between A and C. Refer to Fig. 10 for its circuit. If resistance is not about 2.2kΩ or condenser is conductive, replace filter.
- Continuity of condenser. If ohmmeter indicates conductive, replace condenser.

Install or Connect

1. Noise filter and condenser.
2. Noise filter and condenser connectors.

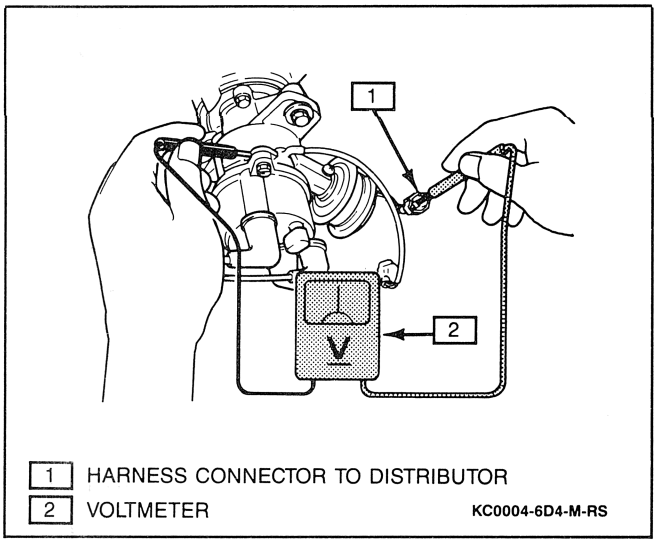

1
2
V
1 HARNESS CONNECTOR TO DISTRIBUTOR
2 VOLTMETER
KC0004-6D4-M-RS

Figure 11 Measuring Distributor Voltage

DISTRIBUTOR

Figures 11 through 14

Remove or Disconnect

1. Battery negative (-) cable.

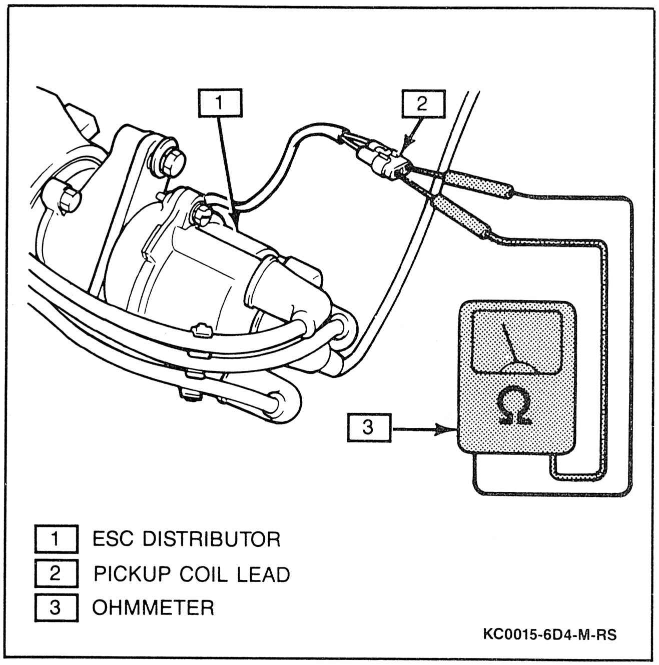

1
2
3
Ω
1 ESC DISTRIBUTOR
2 PICKUP COIL LEAD
3 OHMMETER
KC0015-6D4-M-RS

Figure 12 Measuring Pickup Coil Resistance

2. All electrical and/or vacuum connections.
3. Distributor cap by loosening screws.
4. Mark the distributor housing assembly position on the engine.
5. Mark the rotor position on the distributor housing assembly.
6. Distributor flange bolts.
7. Distributor housing assembly from engine.

Measure

Conventional Vacuum/Centrifugal Spark Control Distributor Only

- Voltage at the distributor harness connector with a voltmeter. If battery voltage is not detected, check the distributor harness connector and the engine wiring harness for faults.

Electronic Spark Control Distributors Only

- Resistance of pickup coil in generator assembly with an ohmmeter. If resistance is not 140 - 180 ohms at approximately 20°C (68°F), replace the generator assembly. Refer to "Electronic Control Distributor" procedure under Unit Repair later in this section.

Install or Connect

1. Distributor housing assembly to engine. Match the marks made on the engine during removal. Be certain that the rotor position also matches the mark on the distributor housing made during removal. Also match the distributor coupling and housing alignment marks. Do not fully tighten the distributor flange bolts since ignition timing may need adjustment.
2. Distributor cap and tighten the screws.
3. All electrical and/or vacuum connections.
4. Battery negative (-) cable.

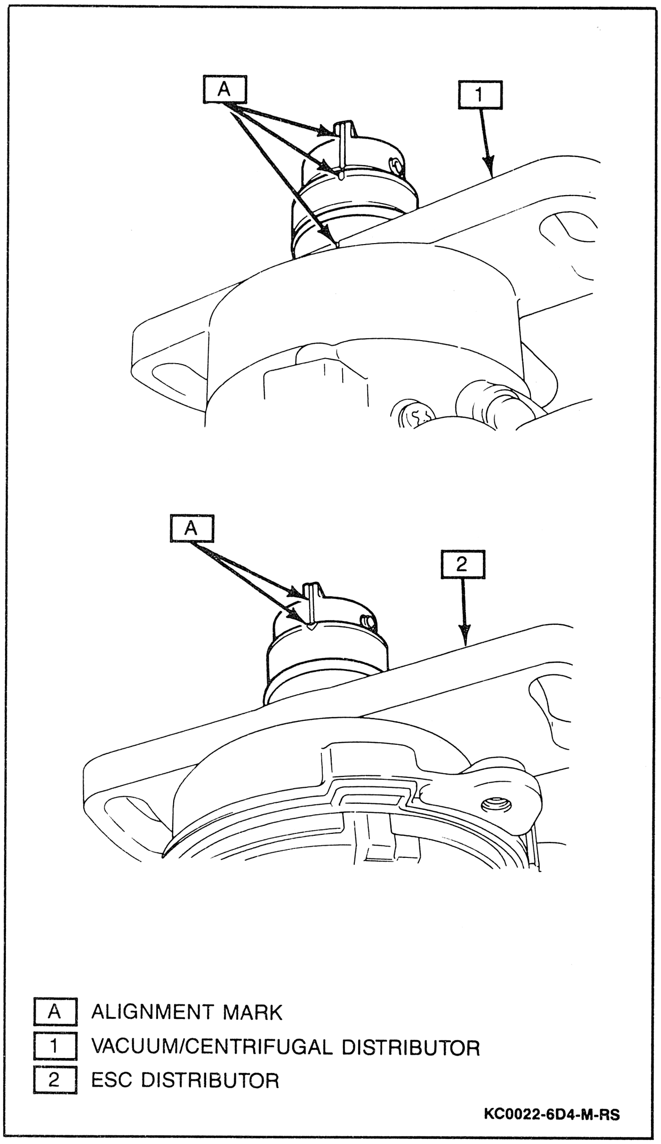

A
1
A
2
A ALIGNMENT MARK
1 VACUUM/CENTRIFUGAL DISTRIBUTOR
2 ESC DISTRIBUTOR
KC0022-6D4-M-RS

Figure 13 Aligning Distributor Marks

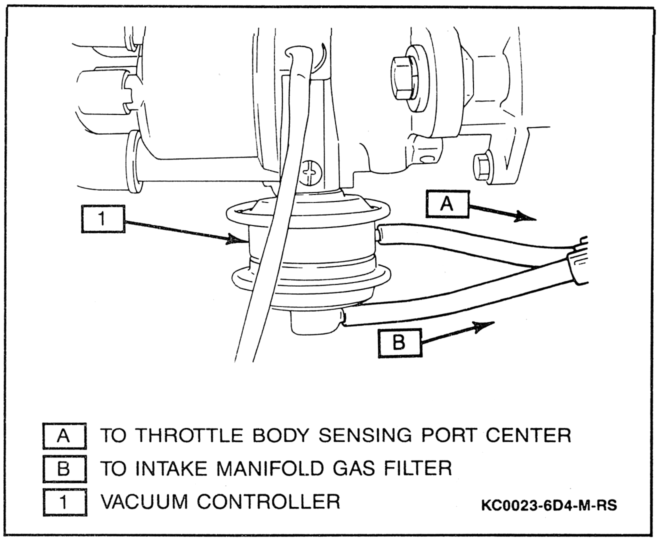

1
A
B
A TO THROTTLE BODY SENSING PORT CENTER
B TO INTAKE MANIFOLD GAS FILTER
1 VACUUM CONTROLLER
KC0023-6D4-M-RS

Figure 14 Vacuum Connections - Conventional Distributor

5. Set ignition timing. Refer to the "Ignition Timing" procedure later in this section.

If Distributor Position Was Lost:

If the engine was accidentally cranked after the distributor was removed, the following procedure can be used for installation:

1. Remove the number 1 spark plug.
2. Place a finger over the number 1 spark plug hole. Have an assistant crank the engine slowly until compression is felt.
3. Align the timing mark on the crankshaft pulley to the "0" position on the timing indicator.
4. Turn the rotor in the distributor housing to point at the number 1 cylinder spark plug tower on the distributor cap.

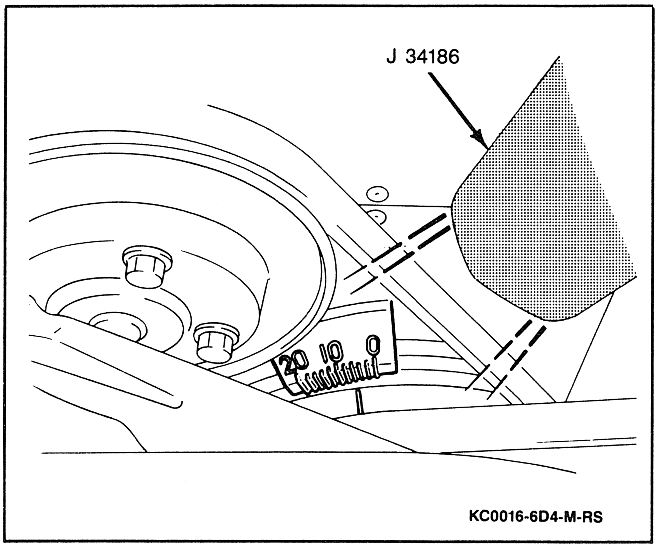


Figure 15 Checking Ignition Timing

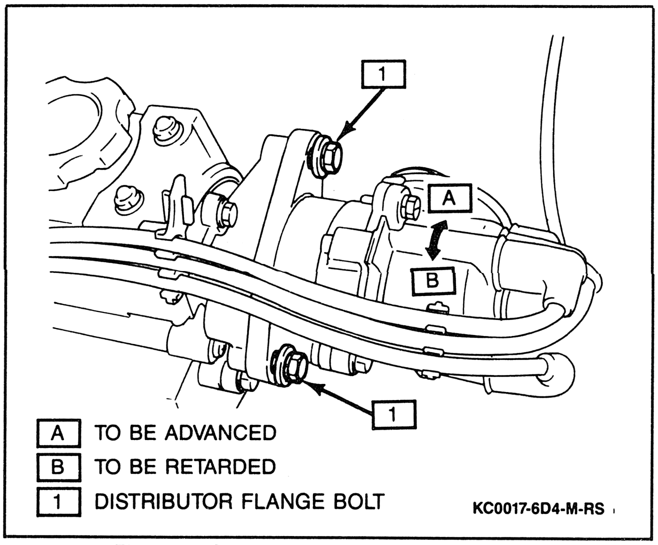


Figure 16 Adjusting Ignition Timing

5. Install the distributor. Refer to the "Distributor" procedure earlier in this section.
6. Check the engine timing. Refer to the "Ignition Timing" procedure later in this section.

IGNITION TIMING

Figures 15 through 17

Tools Required:
J34186 Timing Light

Start and run the engine until operating temperature is reached. Turn all electrical accessories "OFF". Check that the engine idle speed is 750 ± 50 RPM for manual transmission equipped vehicles and 850 ± 50 RPM for automatic transmission equipped vehicles. If the engine idle speed is not within specification, turn the throttle body idle speed adjusting screw until specifications have been met.

With the ignition switch "OFF", connect the pickup lead of a J34186 timing light to the number 1 spark plug. Use a jumper lead between the spark plug wire and the spark plug or use an inductive-type pickup. **Do not** pierce the wire or attempt to insert a probe between the spark plug wire and boot. Connect the timing light power leads according to the manufacturer's instructions.

Conventional Vacuum/Centrifugal Spark Control Distributor

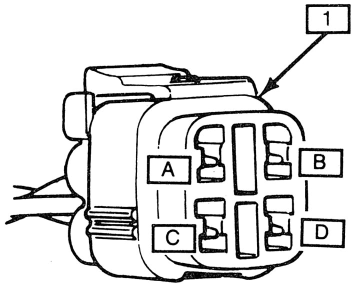
1. Disconnect the vacuum hose at the intake manifold gas filter. Plug the gas filter.
2. Start the engine and aim the J34186 timing light at the timing mark. The line on the pulley will line up at the timing mark. If an adjustment is necessary, loosen the distributor flange bolts. While observing the timing mark with the J34186 timing light, slowly rotate the distributor until the timing mark indicates the specified timing. Adjust the ignition timing to the specifications on the Vehicle Emissions Control Information label located under the hood.
3. Reconnect the vacuum hose to the intake manifold gas filter. Recheck the ignition timing.
    - If the ignition timing does not advance to the specification on the Vehicle Emissions Control Identification label, check for a vacuum leak. If no leak is found, check the vacuum/centrifugal advance mechanism. Refer to the "Conventional Vacuum/Centrifugal Spark Control Distributor" procedure later in this section.
4. Tighten the distributor flange bolts to 13 N·m (120 lb.in.) and recheck the ignition timing.
5. Turn the ignition switch "OFF" and remove the J34186 timing light. Reconnect the number 1 spark plug wire,if removed.

Electronic Spark Control Distributor

1. Remove the diagnostic connector cap. The diagnostic connector is located next to the ignition coil.
2. Insert a jumper wire between the diagnostic connector terminals C and D.
3. Start the engine and aim the J34186 timing light at the timing mark. The line on the pulley will line up at the timing mark. If an adjustment is necessary, loosen the distributor flange bolts. While observing the timing mark with the J34186 timing light, slowly rotate the distributor until the timing mark indicates the specified timing. Adjust the ignition timing to the specifications on the Vehicle Emissions Control Information label

located under the hood. Tighten the distributor flange bolts to 13 N·m (120 lb. in.) and recheck the ignition timing.

4. Remove the jumper wire from the diagnostic connector and reinstall the cap. Make sure that advanced timing is within specification.
5. Turn the ignition switch "OFF" and remove the J34186 timing light. Reconnect the number 1 spark plug wire, if removed.

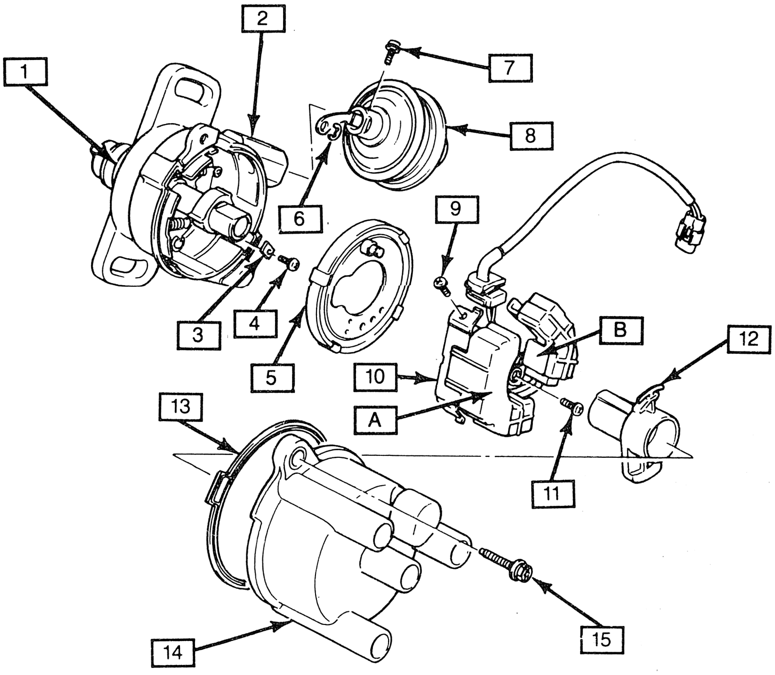


A A/F DUTY CHECK TERMINAL
B DIAGNOSIS SWITCH TERMINAL
C GROUND
D TEST SWITCH TERMINAL
1 DIAGNOSTIC CONNECTOR

KC0018-6D4-M-RS

Figure 17 Diagnostic Connector

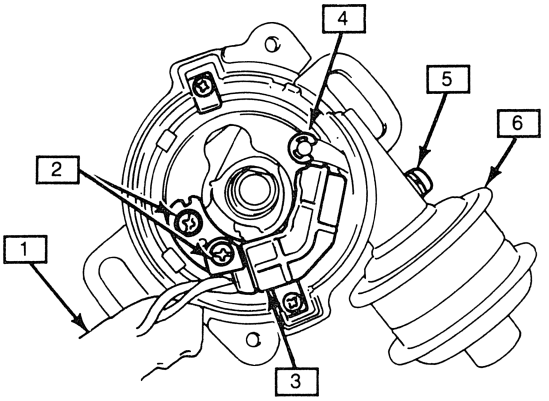
UNIT REPAIR



A IGNITER
B PICKUP COIL
1 O-RING
2 HOUSING WITH CENTRIFUGAL ADVANCER
3 BASE PLATE WASHER
4 SCREW
5 BASE PLATE
6 E-RING
7 CONTROLLER SCREW
8 VACUUM CONTROLLER
9 IGNITER SCREW
10 IGNITER WITH PICKUP COIL
11 PICKUP COIL SCREW
12 ROTOR
13 CAP SEAL
14 CAP
15 CAP SCREW

KC0020-6D4-M-RS

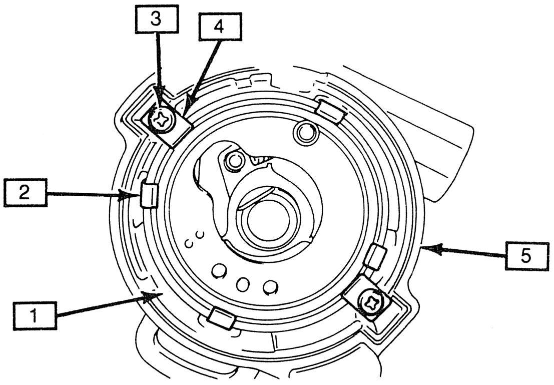
Figure 18 Conventional Distributor Components



1 IGNITER
2 PICKUP COIL SCREW
3 PICKUP COIL
4 E-RING
5 VACUUM CONTROLLER SCREW
6 VACUUM CONTROLLER

KC0025-6D4-M-RS

Figure 19 Removing Conventional Distributor Components



1 BASE PLATE
2 CLIP
3 BASE PLATE SCREW
4 WASHER
5 DISTRIBUTOR HOUSING

KC0026-6D4-M-RS

Figure 20 Removing Distributor Base Plate

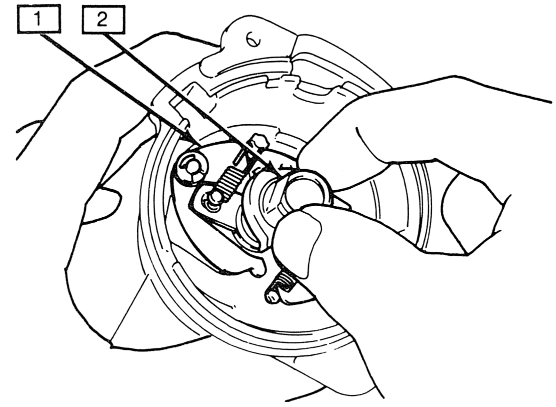
CONVENTIONAL VACUUM/CENTRIFUGAL SPARK CONTROL DISTRIBUTOR

Figures 18 through 24

Remove or Disconnect

Tools Required:
J 34029-A Digital Multimeter

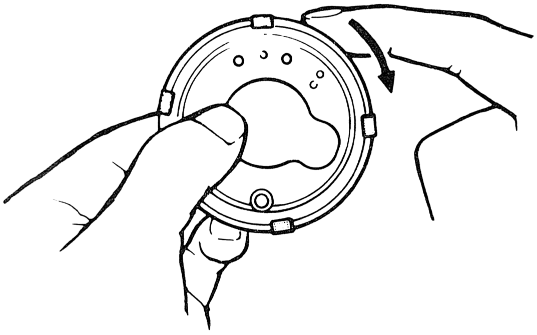
1. Distributor cap from distributor housing.
2. Distributor cap seal from cap.
3. Ignitor and pickup coil.
4. Dust cover from ignitor.
   - Separate pickup coil from ignitor.
5. Red and white wires from ignitor.



1 CENTRIFUGAL ADVANCER
2 SHAFT

KC0027-6D4-M-RS

Figure 21 Checking Centrifugal Advancer



KC0028-6D4-M-RS

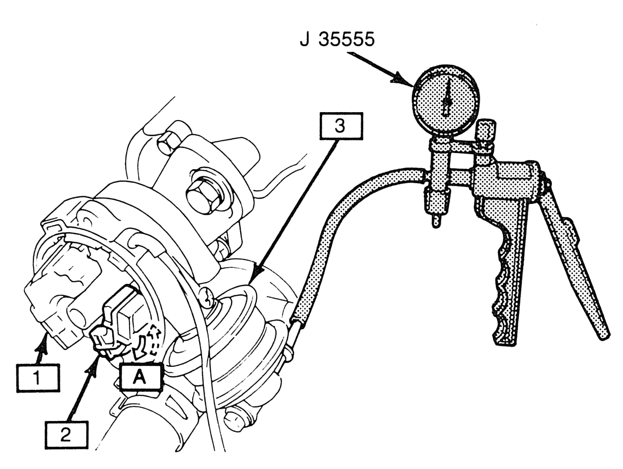
Figure 22 Checking Base Plate

Inspect

- Distributor housing centrifugal advancer mechanism for corrosion or wear. Also check the shaft for end play and the signal rotor for damage or wear. If any defects are noted, replace the distributor housing assembly.
- Base plate and bearing for smooth rotation. Replace as needed.
- Rotor for wear or cracks. Replace as needed.
- Distributor cap for carbon tracking, arcing, or cracks. Replace as needed.
- Distributor housing 0-ring for wear or tears. Replace as needed.

Measure

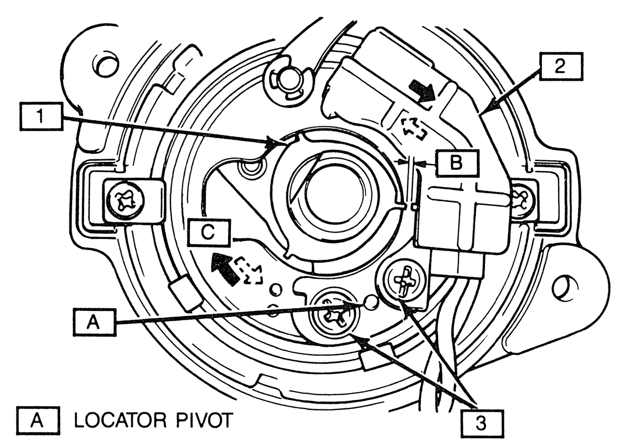
- Using a J 34029-A digital multimeter, measure the resistance of the pickup coil through the red and white wires. The resistance should be between 130 and 190 ohms. If the resistance is not within specification, replace the pickup coil.



A TO BE ADVANCED
1 IGNITER
2 PICKUP COIL
3 VACUUM CONTROLLER

KC0014-6D4-M-RS

Figure 23 Checking Vacuum Diaphragm



A LOCATOR PIVOT
B SIGNAL ROTOR AIR GAP
C TURNING PICKUP COIL WITH BASE PLATE
1 SIGNAL ROTOR
2 PICKUP COIL
3 SCREW WITH LOCK WASHER AND WASHER

KC0029-6D4-M-RS

Figure 24 Adjusting Signal Rotor Air Gap

6. Vacuum controller E-ring and screw.
7. Vacuum controller.
8. Base plate.
9. Distributor housing o-ring.

Install or Connect

Tools Required:
J 35555 Vacuum Pump

1. Distributor housing o-ring.
2. Base plate to distributor housing, using 2 base plate screws and washers.

- During base plate installation, align the base plate clips with the grooves in the distributor housing.

3. Vacuum controller to distributor housing, using the E-ring and screw.

- Using a J 35555 vacuum pump, apply 400 mmHG (15 in.Hg) of vacuum to the vacuum controller outside diaphragm. Hold vacuum for five seconds and release. Repeat this procedure for the inside diaphragm. If the base plate does not move smoothly during both procedures, replace the vacuum controller.

4. Red and white wires from pickup coil to ignitor.
5. Ignitor dust cover.
6. Ignitor and pickup coil to distributor.

- Align a signal rotor ridge with the ridge on the pickup coil.

Adjust

- Signal rotor air gap to 0.2-0.4 mm (0.008-0.016 in.).

7. Rotor to distributor housing shaft.
8. Distributor cap seal.
9. Distributor cap.

ELECTRONIC SPARK CONTROL DISTRIBUTOR

Figure 25

Remove or Disconnect

1. Distributor cap from the distributor housing.
2. Distributor cap seal from the distributor cap.
3. Rotor from the distributor housing shaft.
4. Generator assembly dust cover from the generator assembly.
5. Generator assembly from the distributor housing.
6. Distributor housing 0-ring.

Inspect

- Distributor housing for corrosion or wear. Also check the shaft for end play and the signal rotor for damage or wear. If any defects are noted, replace the distributor housing assembly.
- Rotor for wear or cracks. Replace as needed.
- Distributor cap for carbon tracking, arcing, or cracks. Replace as needed.
- Distributor housing 0-ring for wear or tears. Replace as needed.

Install or Connect

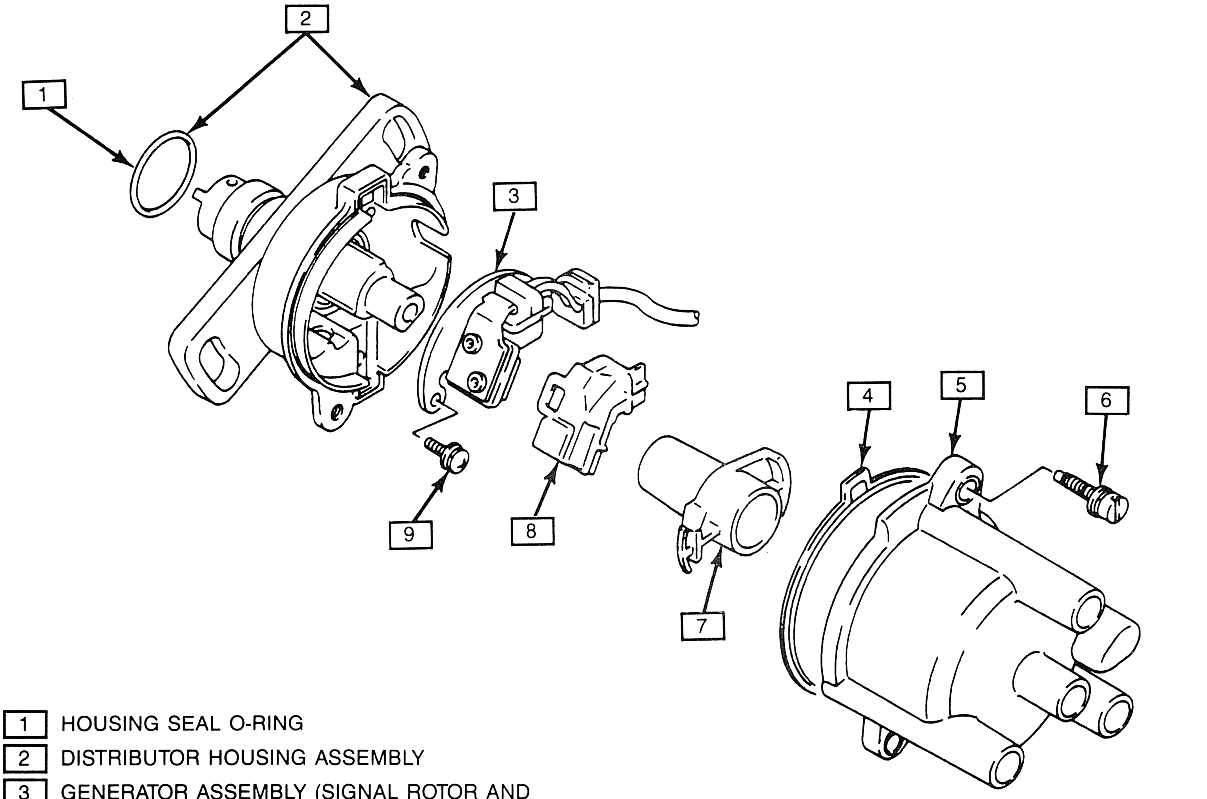
1. Distributor housing 0-ring.
2. Generator assembly to the distributor housing.
3. Generator assembly dust cover to the generator assembly.

- Align a signal rotor ridge with the ridge on the generator assembly.

Adjust

- Signal rotor air gap to 0.2 - 0.4 mm (0.008 - 0.016 in).

4. Rotor to the distributor housing shaft.
5. Distributor cap seal to the distributor cap.
6. Distributor cap to the distributor housing.



1 HOUSING SEAL O-RING
2 DISTRIBUTOR HOUSING ASSEMBLY
3 GENERATOR ASSEMBLY (SIGNAL ROTOR AND PICK-UP COIL)
4 DISTRIBUTOR CAP SEAL
5 DISTRIBUTOR CAP
6 DISTRIBUTOR CAP SCREW
7 ROTOR
8 GENERATOR ASSEMBLY DUST COVER
9 GENERATOR ASSEMBLY SCREW

KC0031-6D4-M-RS

Figure 25 Electronic Spark Control Distributor Components

TORQUE SPECIFICATIONS

Specifications Torque

Spark Plug	28 N·m (21 lb.ft.)
Distributor Flange Bolts	13 N·m (120 lb.in.)
Battery Cable	12 N·m (108 lb.in.)

SPECIAL TOOLS

J34186	Timing Light
J35555	Vacuum Pump

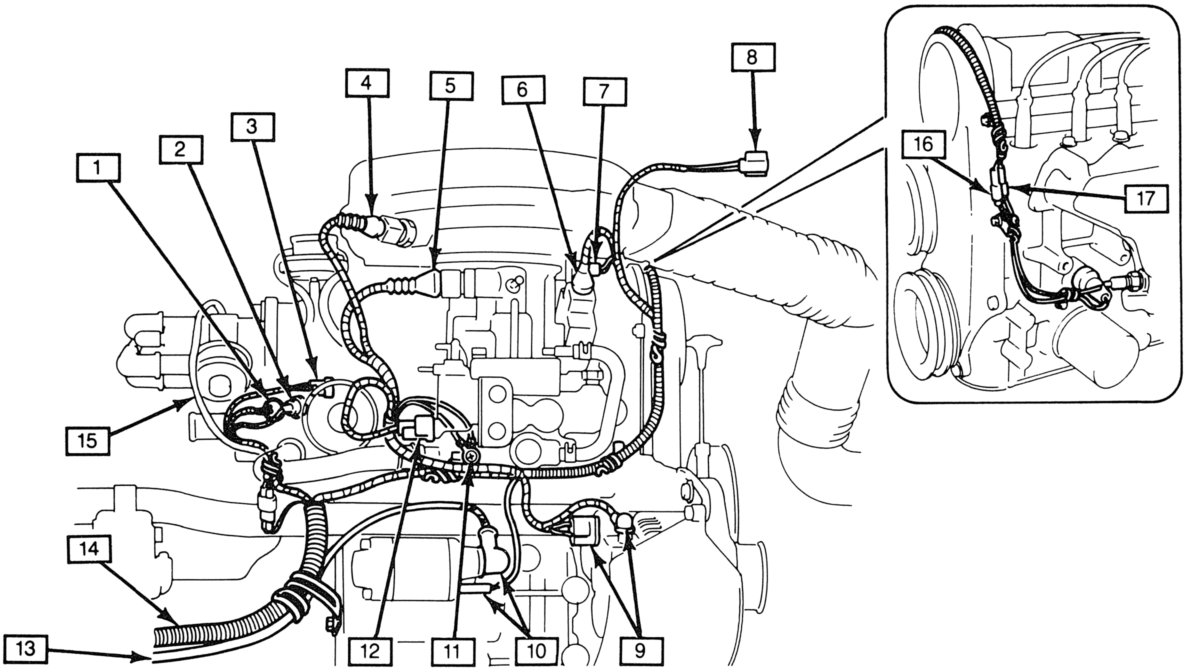
SECTION 6D5

ENGINE WIRING

CONTENTS

Engine Wiring Views 6D5-1

ENGINE WIRING VIEWS



1	RADIATOR COOLING FAN MOTOR SWITCH
2	COOLANT TEMPERATURE GAGE SENDING UNIT
3	EXHAUST GAS RECIRCULATION VACUUM SWITCHING VALVE
4	AIR TEMPERATURE SENSOR
5	COOLANT TEMPERATURE SENSOR
6	THROTTLE POSITION SWITCH (MANUAL TRANSMISSION VEHICLES) THROTTLE POSITION SENSOR (AUTOMATIC TRANSMISSION VEHICLES)
7	FUEL INJECTOR
8	MANIFOLD ABSOLUTE PRESSURE SENSOR CONNECTOR
9	GENERATOR CONNECTIONS
10	STARTER MOTOR CONNECTIONS
11	GROUND CONNECTION
12	IDLE SPEED CONTROL SOLENOID VALVE
13	BATTERY POSITIVE TERMINAL
14	ENGINE WIRING HARNESS
15	DISTRIBUTOR WIRING
16	OXYGEN SENSOR CONNECTOR
17	OIL PRESSURE SWITCH CONNECTOR

KC0001-6D5-M-RS

Figure 1 Engine Wiring

SECTION 6E

DRIVEABILITY AND EMISSIONS GENERAL INFORMATION

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DRIVEABILITY AND EMISSIONS CONTROL

The computer command control system, which is controlled by the Electronic Control Module (ECM), is designed to maintain exhaust emission levels at federal standards while providing good driveability and fuel efficiency. The functions of the system are based on data gathered by sensors and switches located throughout the vehicle. The ECM maintains control over fuel delivery, ignition, idle air flow, the fuel pump and other system components, while monitoring the system for faulty operation with its diagnostic capabilities. See Figure 1.

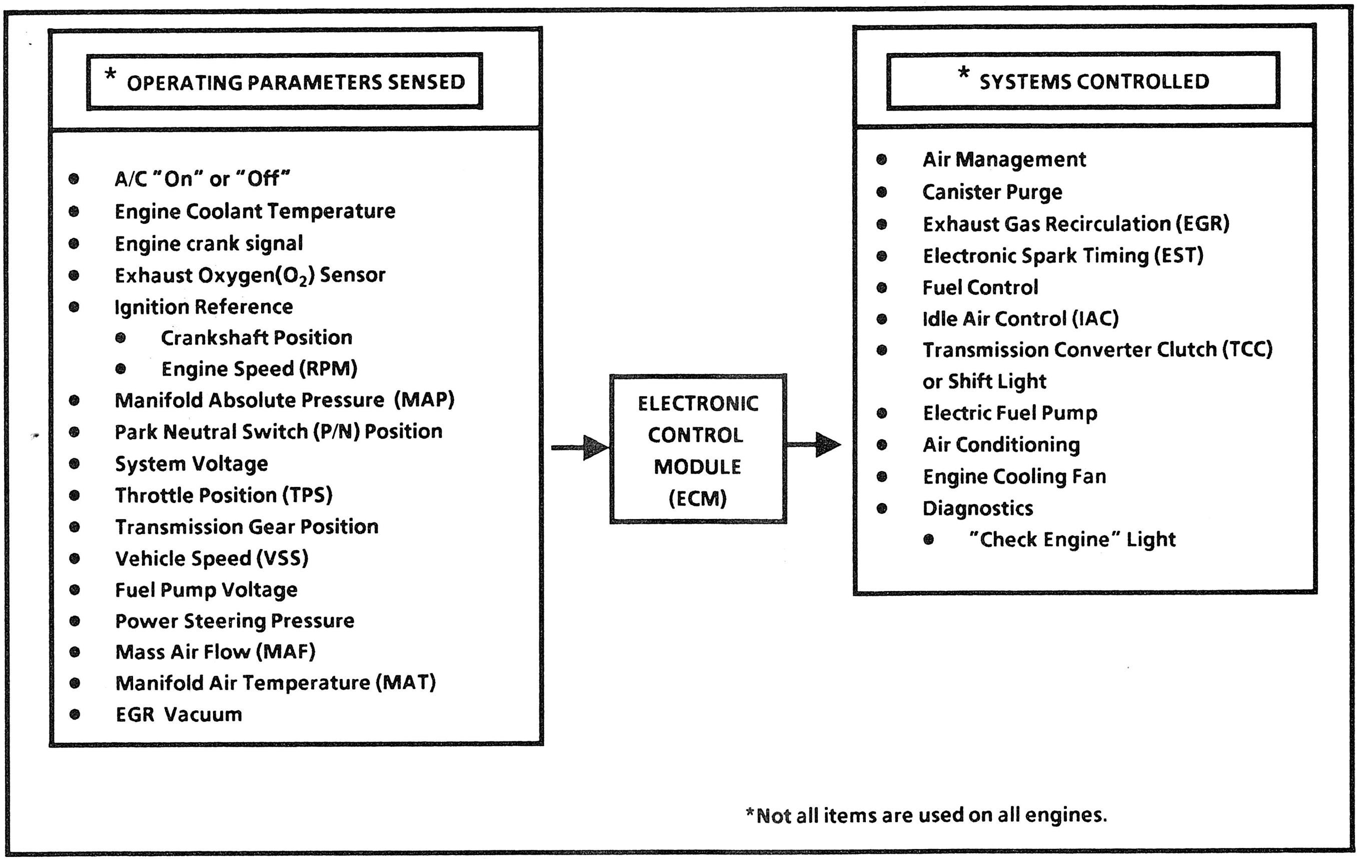
It is important to review the component sections and wiring diagrams in Section "6E2" to determine which systems are controlled by the ECM.

EMISSIONS CONTROL INFORMATION LABEL

The underhood Vehicle Emissions Control Information label (Figure 2) contains important emission specifications and setting procedures. In the upper left corner is exhaust emission information which identifies the year, the manufacturing division of the engine, the displacement of the engine in liters, the class of vehicle, and type of fuel metering. There is also an illustrated emission component and vacuum hose schematic.

This label is located in the engine compartment of every General Motors vehicle. If the label has been removed, it can be ordered from GM Service Parts Organization (GMSPO).

ALL NEW GENERAL MOTORS VEHICLES ARE CERTIFIED BY THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY AS CONFORMING TO THE REQUIREMENTS OF THE REGULATIONS FOR THE CONTROL OF AIR POLLUTION FROM NEW MOTOR VEHICLES. THIS CERTIFICATION IS CONTINGENT ON CERTAIN ADJUSTMENTS BEING SET TO FACTORY STANDARDS. IN MOST CASES, THESE ADJUSTMENT POINTS EITHER HAVE BEEN PERMANENTLY SEALED AND/OR MADE INACCESSIBLE TO PREVENT INDISCRIMINATE OR ROUTINE ADJUSTMENT IN THE FIELD. FOR THIS REASON, THE FACTORY PROCEDURE FOR TEMPORARILY REMOVING PLUGS, CAPS, ETC., FOR PURPOSES OF SERVICING THE PRODUCT, MUST BE STRICTLY FOLLOWED AND, WHEREVER PRACTICABLE, RETURNED TO THE ORIGINAL INTENT OF THE DESIGN.


* OPERATING PARAMETERS SENSED
A/C "On" or "Off"
Engine Coolant Temperature
Engine crank signal
Exhaust Oxygen(O2) Sensor
Ignition Reference
Crankshaft Position
Engine Speed (RPM)
Manifold Absolute Pressure (MAP)
Park Neutral Switch (P/N) Position
System Voltage
Throttle Position (TPS)
Transmission Gear Position
Vehicle Speed (VSS)
Fuel Pump Voltage
Power Steering Pressure
Mass Air Flow (MAF)
Manifold Air Temperature (MAT)
EGR Vacuum
ELECTRONIC CONTROL MODULE (ECM)
* SYSTEMS CONTROLLED
Air Management
Canister Purge
Exhaust Gas Recirculation (EGR)
Electronic Spark Timing (EST)
Fuel Control
Idle Air Control (IAC)
Transmission Converter Clutch (TCC) or Shift Light
Electric Fuel Pump
Air Conditioning
Engine Cooling Fan
Diagnostics
"Check Engine" Light

*Not all items are used on all engines.

Figure 1 - ECM Inputs and Outputs

MAINTENANCE SCHEDULE

Refer to the General Motors Maintenance Schedule in Section "0B" of the Chassis Service Manual for the maintenance service that should be performed to retain emission control performance.

BLOCKING DRIVE WHEELS

The vehicle drive wheels always should be blocked and parking brake firmly set while checking the system.

WHAT THIS SECTION CONTAINS

This section of the Chassis Service Manual has been developed to describe the function and operation of the electronic engine control system that controls the driveability and emissions of the vehicle. Emphasis is placed on the diagnosis and repair of problems related to the system.

Section "6E" provides general diagnostic procedures, use, wiring and terminal repair procedures, and descriptions of special tools. It then leads into Sections "6E2". Section "6E2" deals with engine control systems using throttle body injection for fuel delivery.

Sections "6E2" is divided into three major sub-sections dealing with diagnosis and repair. They can be summarized as follows.

SECTION A: CIRCUIT INFORMATION & DIAGNOSIS

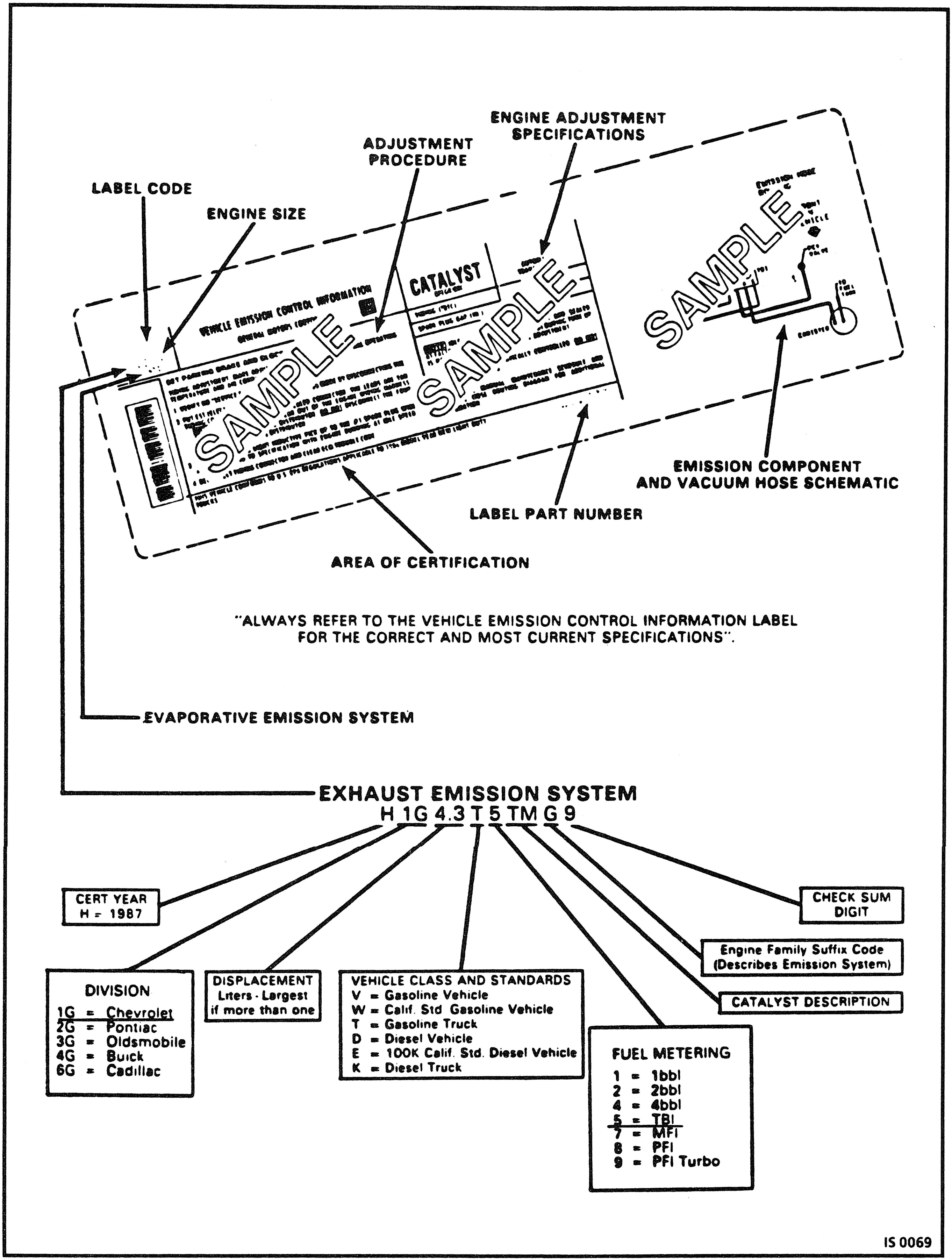
- Component Locations
- Wiring Diagrams
- ECM Terminal End View and Terminal Definitions
- Diagnostic Circuit Check. This must be the first step of any diagnostic procedure.
- Diagnostic Trouble Code Charts with facing pages containing circuit diagrams, circuit operation information, and helpful diagnostic information.

SECTION B: DRIVEABILITY & EMISSIONS SYMPTOMS

- This sub-section assists in diagnosis of intermittent problems or problems which don't result in the storing of diagnostic trouble codes. It is arranged by symptoms of poor driveability and emissions and lists possible causes of the problems.

SECTION C: COMPONENT CHECKS & SERVICE

- Component and Circuit Descriptions
- On-car Service
- Functional Checks/Diagnostic Charts


ENGINE ADJUSTMENT SPECIFICATIONS
ADJUSTMENT PROCEDURE
LABEL CODE
ENGINE SIZE
VEHICLE EMISSION CONTROL INFORMATION
CATALYST
SAMPLE
SAMPLE
SAMPLE
EMISSION COMPONENT AND VACUUM HOSE SCHEMATIC
LABEL PART NUMBER
AREA OF CERTIFICATION
EVAPORATIVE EMISSION SYSTEM
EXHAUST EMISSION SYSTEM
H 1G 4.3 T 5 TM G 9
CERT YEAR H = 1987
CHECK SUM DIGIT
Engine Family Suffix Code (Describes Emission System)
CATALYST DESCRIPTION
DIVISION
1G = Chevrolet
2G = Pontiac
3G = Oldsmobile
4G = Buick
6G = Cadillac
DISPLACEMENT Liters - Largest if more than one
VEHICLE CLASS AND STANDARDS
V = Gasoline Vehicle
W = Calif. Std Gasoline Vehicle
T = Gasoline Truck
D = Diesel Vehicle
E = 100K Calif. Std. Diesel Vehicle
K = Diesel Truck
FUEL METERING
1 = 1bbl
2 = 2bbl
4 = 4bbl
5 = TBI
7 = MFI
8 = PFI
9 = PFI Turbo
IS 0069

"ALWAYS REFER TO THE VEHICLE EMISSION CONTROL INFORMATION LABEL FOR THE CORRECT AND MOST CURRENT SPECIFICATIONS".

Figure 2 - Vehicle Emission Control Information Label

VISUAL/PHYSICAL UNDERHOOD INSPECTION

A careful visual and physical underhood inspection must be performed as part of any diagnostic procedure or in finding the cause of an emissions test failure. This can often lead to fixing a problem without further steps. Inspect all vacuum hoses for correct routing, pinches, cuts, or disconnects. Be sure to inspect hoses that are difficult to see beneath the air cleaner, compressor, generator, etc. Inspect all the wires in the engine compartment for proper connections, burned or chafed spots, pinched wires, or contact with sharp edges or hot exhaust manifolds. This visual/physical inspection is very important. It must be done carefully and thoroughly.

BASIC KNOWLEDGE AND TOOLS REQUIRED

To use this manual most effectively, a general understanding of basic electrical circuits and circuit testing tools is required. One should be familiar with wiring diagrams, the meaning of voltage, ohms, amps, the basic theories of electricity, and understand what happens in an open or shorted wire.

To perform system diagnosis, the use of a tachometer, test light, ohmmeter, digital voltmeter with 10 megohms impedance, vacuum gauge, and jumper wires are also required. Please become acquainted with the tools and their use before attempting to diagnose a vehicle. Special tools which are required for system service and the ones described above are illustrated at the end of this section.

Electrostatic Discharge Damage

Electronic components used in control systems are often designed to carry very low voltage, and are very susceptible to damage caused by electrostatic discharge. It is possible for less than 100 volts of static electricity to cause damage to some electronic components. By comparison, it takes as much as 4,000 volts for a person to even feel the zap of a static discharge.

There are several ways for a person to become statically charged. The most common methods of charging are by friction and by induction. An example of charging by friction is a person sliding accross a car seat, in which a charge of as much as 25,000 volts can build up. Charging by induction occurs when a person with well insulated shoes stands near a highly charged object and momentarily touches ground. Charges of the same polarity are drained off, leaving the person highly charged with the opposite polarity. Static charges of either type can cause damage, therefore, it is important to use care when handling and testing electronic components.

NOTICE: To prevent possible Electrostatic Discharge damage:

- Do Not touch the ECM connector pins or soldered components on the ECM circuit board.

DIAGNOSTIC INFORMATION

The diagnostic "trouble tree" charts and functional checks in this manual are designed to locate a faulty circuit or component through logic based on the process of elimination. The charts are prepared with the requirement that the vehicle functioned correctly at the time of assembly and that there are no multiple failures.

The ECM performs a continual self-diagnosis on certain control functions. This diagnostic capability is complemented by the diagnostic procedures contained in this manual. The ECM's language for communicating the source of a malfunction is a system of diagnostic trouble codes. The codes are two or three digit numbers that can range from 12 to 51. When a malfunction is detected by the ECM, a code is set and the "Check Engine" light is illuminated.

"Check Engine" Light

This light is on the instrument panel and has the following functions.

- It informs the driver that a problem has occurred and that the vehicle should be taken for service as soon as reasonably possible.
- It displays "Trouble Codes" stored by the ECM which help the technician diagnose system problems, when diagnostic terminal is grounded with spare fuse in fuse box.

As a bulb and system check, the light will come "ON" with the key "ON" and the engine not running. When the engine is started, the light will turn "OFF." If the light remains "ON," the self-diagnostic system has detected a problem. If the problem goes away, the light will go out in most cases after 10 seconds, but a Trouble Code will remain stored in the ECM.

When the light remains "ON" while the engine is running, or when a malfunction is suspected due to a driveability or emissions problem, a **"Diagnostic Circuit Check" must be performed**. The procedures for these checks are given in Section "A" of "6E2". These checks will expose malfunctions which may not be detected if other diagnostics are performed prematurely.

Intermittent "Check Engine" Light

In the case of an "intermittent" problem, the "Check Engine" light will remain "ON" as long as the trouble exists and will turn "OFF" when the system returns to normal. **Except in the case of EGR intermittents.** EGR intermittents will cause the light to remain "ON" until the ignition switch is turned "OFF".

Corresponding trouble code will be stored in the memory of the ECM until the battery voltage to the ECM has been removed, **except** in the case of the ESA model for Code 41, the ignition circuit. Code 41 does not store in the memory of the ECM for the **ESA** Metro. When the engine fails to start, crank the engine, and then ground the diagnostic switch terminal with the ignition "ON", to read codes.

When unexpected codes appear during the code reading process, one can assume that these codes were set by an intermittent malfunction and could be helpful in diagnosing the system.

An intermittent code may or may not re-set. If it is an intermittent failure, a Diagnostic Trouble Code Chart is not used. Consult the "Diagnostic Aids" on the page facing the diagnostic chart corresponding to the intermittent trouble code. Section "B" also covers the topic of "Intermittents." A physical inspection of the applicable sub-system most often will resolve the problem.

Reading Codes

The provision for reading trouble codes is a Diagnosis Switch Terminal located in the passenger compartment fuse block. The ECM has a 5 volt line to the terminal. Using a spare fuse, this line is connected to ground. The ECM will then toggle the "Check Engine" light to emit any trouble codes stored in the ECM. If no codes exist a Code 12 will flash. If trouble code(s) exist the lowest numbered code will flash first. Each code will flash 3 times. If no codes exist and a driveability problem is present refer to the "Symptoms" in Section "B" of the present service manual. If codes are stored refer to Section "A".

The output of Code 12 indicates that the "Check Engine" light is operating normally and that no other codes are stored in ECM memory. If more than one diagnostic trouble code has been stored in the ECM's memory, the codes will be output from the lowest to the highest, with each code being displayed three times.

Clearing Codes

To clear the codes from the memory of the ECM, either to determine if the malfunction will occur again or because repair has been completed, the ECM power feed must be disconnected for at least thirty (30) seconds. To remove power from the ECM, remove the "Tail lamp" fuse, located in the passenger compartment fuse block. If under the hood, the 30A main fuse (pink) in the fuse holder on the right, front fender apron, can be removed to disconnect power to the ECM. Removal of the 30A main fuse will erase memory in the clock and/or radio, so use of the "Tail lamp" fuse for this purpose is preferred.

CAUTION: **To prevent ECM damage, the key must be "OFF" when disconnecting or reconnecting ECM power.**

Diagnostic Mode

When the Diagnostic terminal is grounded with the ignition "ON" and the engine "OFF," the system will enter what is called the Diagnostic Mode. In this mode the ECM will operate the "Check Engine" light as follows:

- Display a Code 12 by flashing the "Check Engine" light (indicating the system is operating correctly).
- If any other codes than Code 12 are stored, they will be displayed by flashing the "Check Engine" light. Each code will be flashed three times, Code 12 will not flash if other codes are stored.

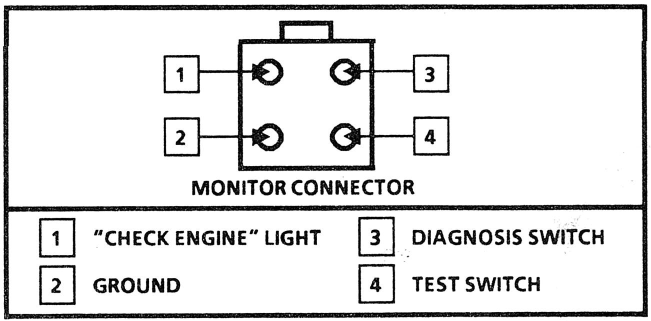


Figure 3 - Monitor Connector (Underhood)

DIAGNOSTIC CIRCUIT CHECK

After the visual/physical underhood inspection, the "Diagnostic Circuit Check" is the starting point for all diagnostic procedures or finding the cause of an emissions test failure.

The correct procedure to diagnose a problem is to follow three basic steps.

1. Are the On-Vehicle Diagnostics working? This is determined by performing the "Diagnostic Circuit Check." Since this is the starting point for the diagnostic procedures or finding the cause of an emissions test failure, *always begin here.*

   If the On-Vehicle Diagnostics aren't working, the "Diagnostic Circuit Check" will lead to a diagnostic chart in Section "A" to correct the problem. If the On-Vehicle Diagnostics are working correctly, the next step is

2. Is there a Trouble Code stored? If a trouble code is stored, go directly to the numbered code chart in Section "A". This will determine if the fault is still present.

EXHAUST GAS RECIRCULATION (EGR)

The EGR system uses a valve to feed a small amount of exhaust gas back into the intake manifold to control formation of NOx.

SHIFT LIGHT CONTROL

The ECM controls the shift light on some manual transmission vehicles to indicate the best shift point for maximum fuel economy. This control is not on all applications.

POSITIVE CRANKCASE VENTILATION (PCV) OR CRANKCASE VENTILATION (CV)

The PCV or CV system passes crankcase vapors into the intake manifold. This system is not controlled by the ECM and is used on all engines.

ABBREVIATIONS AND GLOSSARY OF TERMS

Abbreviations used in this section are listed below in alphabetical order with an explanation of the abbreviation. There are some variations in the use of periods and in capitalization (as mph, m.p.h., Mph, and MPH) for abbreviations used in this Section, but all types are acceptable.

A/T - AUTOMATIC TRANSMISSION

ATS - AIR TEMPERATURE SENSOR - Measures the underhood temperature.

BVSV - BIMETAL VACUUM SWITCHING VALVE - Temperature controlled vacuum switch, that is used to route or exhaust vacuum at various engine temperatures.

CTS - COOLANT TEMPERATURE SENSOR

ECM - ENGINE CONTROL MODULE (ELECTRONIC) - A metal case (located in passenger compartment) containing electronic circuitry which electrically controls and monitors air/fuel and emission systems on computer command control, and turns "ON" the "Check Engine" light when a malfunction occurs in the system.

EFI - ELECTRONIC FUEL INJECTION - Computer Command Control using throttle body fuel injection.

EGR - EXHAUST GAS RECIRCULATION - Method of reducing NOx emission levels by causing exhaust gas to be added to air/fuel mixture in combustion chamber, thus cooling combustion.

ESA - ELECTRONIC SPARK ADVANCE - ECM controlled spark timing.

FED - FEDERAL - Vehicle/Engine available in all states except California.

GROUND - The negative (-) side of the battery. Also could be a wire (conductor) shorted to ground.

HC - HYDROCARBONS - One of the pollutants found in engine exhaust.

Hg - MERCURY - A calibration material used as a standard for vacuum measurement.

HIGH IMPEDANCE VOLTMETER - Has high opposition to the flow of electrical current. Good for reading circuits with low current flow, such as found in electronic systems because it allows tests to be made without affecting the circuit.

IDEAL MIXTURE - The air/fuel ratio which provides the best performance, while maintaining maximum conversion of exhaust emissions. Typically it is 14.7:1.

IGN - IGNITION

INPUTS - Information from sources (such as coolant temperature sensors, exhaust oxygen sensor, etc.) to the ECM that indicate how the systems are performing.

INTERMITTENT - Occurs now and then; not continuously. In electrical circuits, refers to occasional open, short, or ground.

I.P. - INSTRUMENT PANEL

ISC - IDLE SPEED CONTROL - ECM controlled solenoid used to route vacuum to control idle speed under various engine loads.

KM/HR - KILOMETER PER HOUR - A metric unit measuring speed needed to travel distance of one kilometer (1000 meters) in one hour.

L - LITER - A metric unit of capacity.

MALFUNCTION - A problem that causes the system to operate incorrectly. Typical malfunctions are wiring harness opens or shorts, failed sensors or circuit components.

MAP - MANIFOLD AIR PRESSURE - Air pressure in the intake manifold with reference to zero or absolute vacuum.

MAT - MANIFOLD AIR TEMPERATURE - Air temperature in the intake manifold.

MODE - A particular state of operation.

MPH - MILES PER HOUR - A unit measuring speed needed to travel distance of one mile (5280 feet) in one hour.

M/T - MANUAL TRANSMISSION

N.C. - NORMALLY CLOSED - State of relay contacts or solenoid plunger when no voltage is applied.

N·m - NEWTON METER (Torque) - A metric unit describing force.

N.O. - NORMALLY OPEN - State of relay contacts or solenoid plunger when no voltage is applied.

NOx - NITROGEN, OXIDES OF - One of the pollutants found in engine exhaust.

0_2 - OXYGEN (Sensor) - Monitors the oxygen content of the exhaust system and generates a voltage signal to the ECM.

OUTPUT - Result of a function typically controlled by the ECM.

OXYGEN SENSOR, EXHAUST - Device that detects the amount of oxygen (0_2) in the exhaust stream.

PCV - POSITIVE CRANKCASE VENTILATION - Prevent fumes in crankcase from passing into atmosphere.

P/N - PARK/NEUTRAL

PORT - EXHAUST OR INTAKE PORT

PROM - PROGRAMMABLE READ ONLY MEMORY - An electronic term used to describe the engine calibration unit.

RPM - REVOLUTIONS PER MINUTE - A measure of rotational speed.

SELF-DIAGNOSTIC CODE - The ECM can detect malfunctions in the system. If a malfunction occurs, the ECM turns "ON" the "Check Engine" light. A diagnostic code can be obtained from the ECM through the "Check Engine" light, or by use of a "Scan" tool. This code will indicate the area of the malfunction.

TACH - TACHOMETER

TB - THROTTLE BODY

TBI - THROTTLE BODY INJECTION (Unit) - Is controlled by the ECM to supply precise air/fuel mixture into the intake manifold.

TPS - THROTTLE POSITION SENSOR

TS - THROTTLE SWITCH

VACUUM - Negative pressure; less than atmospheric pressure.

VACUUM, MANIFOLD - Vacuum source in manifold below throttle plate.

VACUUM, PORTED - A vacuum source above (atmospheric side) of closed throttle plate.

VIN - VEHICLE IDENTIFICATION NUMBER

VSS - VEHICLE SPEED SENSOR - Sensor which sends vehicle speed information to the ECM.

VSV - VACUUM SWITCHING VALVE

WOT - WIDE OPEN THROTTLE

WTG - WATER TEMPERATURE GAUGE

WIRING HARNESS SERVICE

Wire harnesses should be replaced with proper part number harnesses. When signal wires are spliced into a harness, use wire with high temperature insulation only. See Figure 4 for instructions.

With the low current and voltage levels found in the system, it is important that the best possible bond be made at all wire splices by soldering the splices as shown.

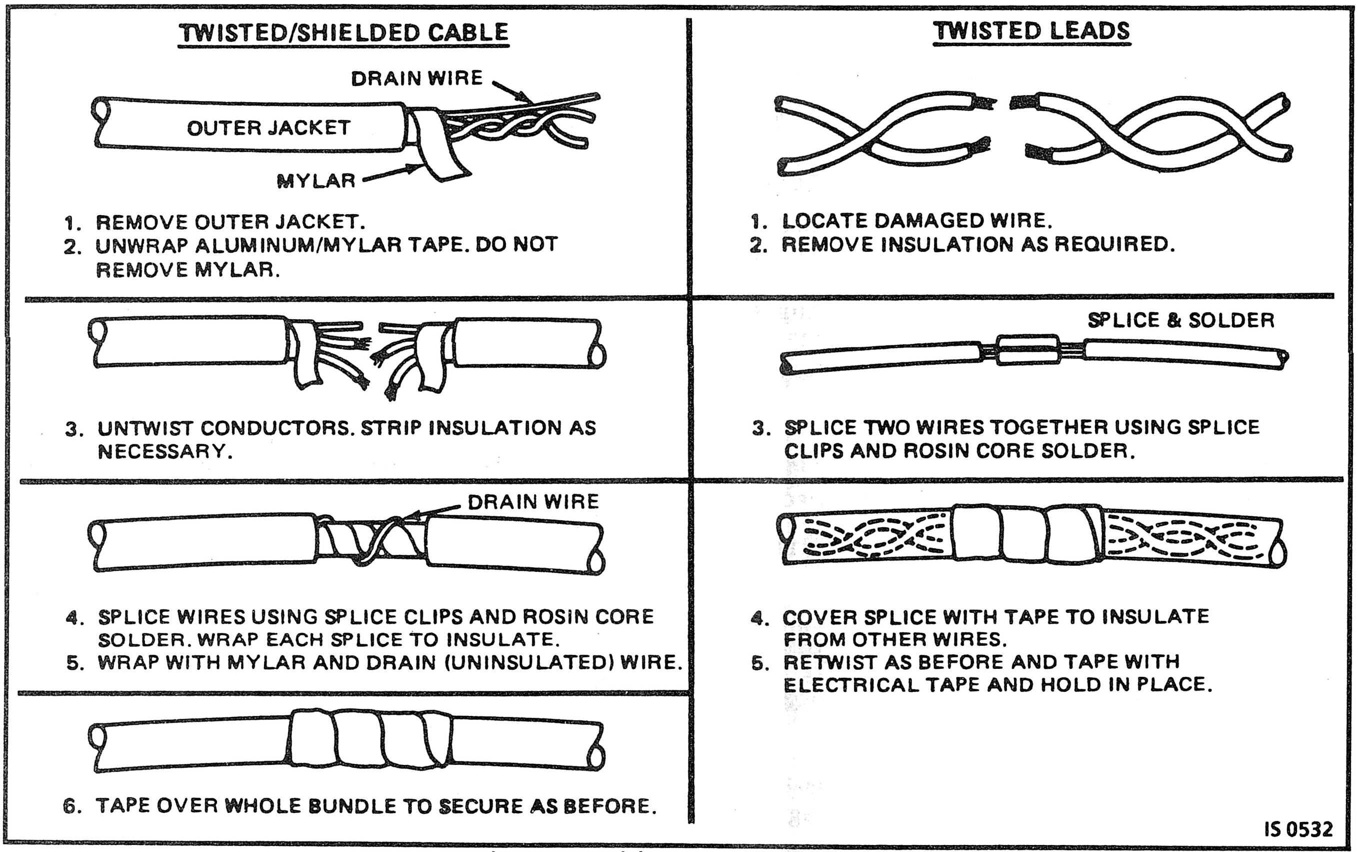
Use care when probing a connector or replacing connector terminals. It is possible to short between opposite terminals. If this happens, certain components can be damaged. Always use jumper wires between connectors for circuit checking. **NEVER** probe through connector seals, wire insulation, secondary ignition wires, boots, nipples, or covers. Even microscopic damage or holes may result in eventual water intrusion, corrosion and/or component or circuit failure.

WIRING CONNECTOR SERVICE

Most connectors in the engine compartment are protected against moisture and dirt which could create oxidation and deposits on the terminals. This protection is important because of the very low voltage and current levels found in the electronic system. The connectors have a lock which secures the male and female terminals together. A secondary lock holds the seal and terminal into the connector.

When diagnosing, open circuits are often difficult to locate by sight because oxidation or terminal misalignment are hidden by the connectors. Merely wiggling a connector on a sensor or in the wiring harness may locate the open circuit condition. This should always be considered when an open circuit or failed sensor is indicated. Intermittent problems may also be caused by oxidized or loose connections.

Before making a connector repair, be certain of the type of connector. Weather-Pack and Compact Three connectors look similar but are serviced differently. Replacement connectors and terminals are listed in Group 8.965 of the Standard Parts Catalog.



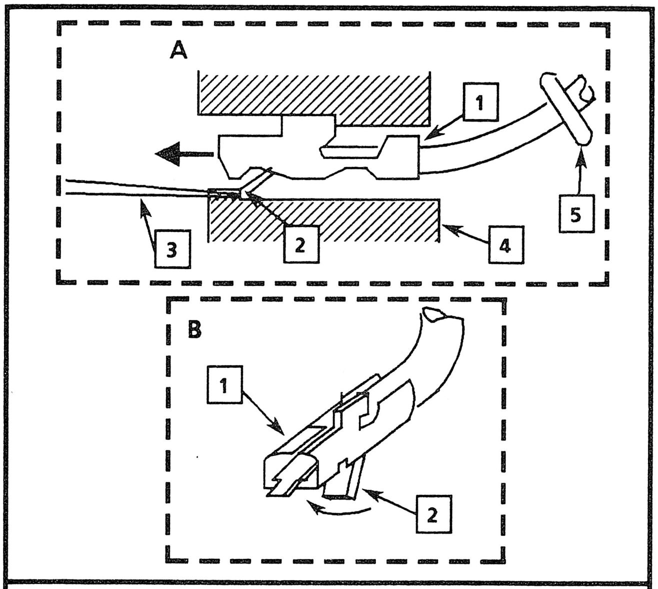
TWISTED/SHIELDED CABLE

1. REMOVE OUTER JACKET.
2. UNWRAP ALUMINUM/MYLAR TAPE. DO NOT REMOVE MYLAR.
3. UNTWIST CONDUCTORS. STRIP INSULATION AS NECESSARY.
4. SPLICE WIRES USING SPLICE CLIPS AND ROSIN CORE SOLDER. WRAP EACH SPLICE TO INSULATE.
5. WRAP WITH MYLAR AND DRAIN (UNINSULATED) WIRE.
6. TAPE OVER WHOLE BUNDLE TO SECURE AS BEFORE.

TWISTED LEADS

1. LOCATE DAMAGED WIRE.
2. REMOVE INSULATION AS REQUIRED.
3. SPLICE TWO WIRES TOGETHER USING SPLICE CLIPS AND ROSIN CORE SOLDER.
4. COVER SPLICE WITH TAPE TO INSULATE FROM OTHER WIRES.
5. RETWIST AS BEFORE AND TAPE WITH ELECTRICAL TAPE AND HOLD IN PLACE.

Figure 4 - Wiring Harness Repair



1 METRI-PACK SERIES 150 FEMALE TERMINAL
2 LOCKING TANG
3 TOOL J35689 OR BT-8446
4 CONNECTOR BODY
5 SEAL

Figure 5 - Metri-Pack Series 150 Terminal Removal

Metri-Pack Series 150 Terminals

Some ECM harness connectors contain terminals called Metri-Pack (Figure 5). These may be used at the coolant sensors as well as at ignition modules.

Metri-Pack terminals are also called "Pull-To-Seat" terminals because to install a terminal on a wire, the wire is first inserted through the seal (5) and connector (4). The terminal is then crimped on the wire, and the terminal pulled back into the connector to seat it in place.

To remove a terminal:

1. Slide the seal back on the wire.
2. Insert tool (3) BT-8518, J 35689, or equivalent as shown in insert "A" and "B" to release the terminal locking tang (2).
3. Push the wire and terminal out through the connector.

If the terminal is being reused, reshape the locking tang (2).

Weather-Pack Connectors

Figure 6 shows a Weather-Pack connector and the tool (J 28742, BT-8234-A or equivalent) required to service it. This tool is used to remove the pin and sleeve terminals. If terminal removal is attempted with an ordinary pick, there is a good chance that the terminal will be bent or deformed, and unlike standard blade type terminals, these terminals cannot be straightened once they are bent.

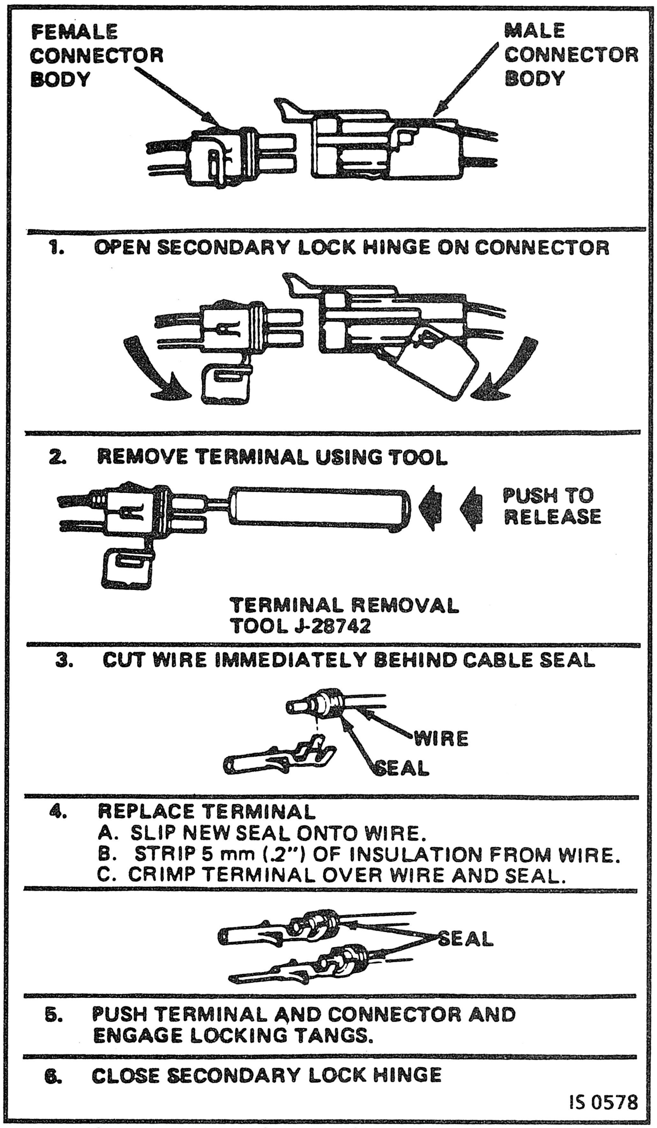

FEMALE CONNECTOR BODY
MALE CONNECTOR BODY
1. OPEN SECONDARY LOCK HINGE ON CONNECTOR
2. REMOVE TERMINAL USING TOOL
PUSH TO RELEASE
TERMINAL REMOVAL TOOL J-28742
3. CUT WIRE IMMEDIATELY BEHIND CABLE SEAL
WIRE
SEAL
4. REPLACE TERMINAL
A. SLIP NEW SEAL ONTO WIRE.
B. STRIP 5 mm (.2") OF INSULATION FROM WIRE.
C. CRIMP TERMINAL OVER WIRE AND SEAL.
SEAL
5. PUSH TERMINAL AND CONNECTOR AND ENGAGE LOCKING TANGS.
6. CLOSE SECONDARY LOCK HINGE
IS 0578

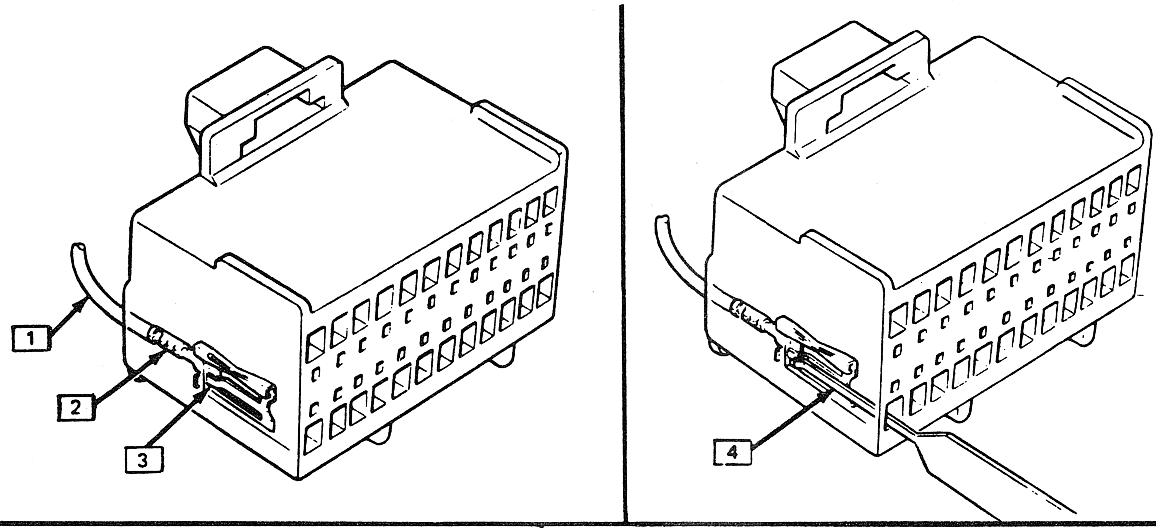
Figure 6 - Weather-Pack Terminal Repair

Make certain that the connectors are properly seated and all of the sealing rings in place when connecting leads. The hinge-type flap provides a secondary locking feature for the connector. It improves the connector reliability by retaining the terminals if the small terminal lock tangs are not positioned properly.

Weather-Pack connections cannot be replaced with standard connections. Instructions are provided with Weather-Pack connector and terminal packages.

Compact Three Connectors

The Compact Three connector, which looks similar to a Weather-Pack connector, is not sealed and is used where resistance to the environment is not required. This type of connector most likely is used at the AIR control solenoid. Use the standard method when repairing a terminal. Do not use the Weather-pack terminal tool J 28742.



1 CABLE
2 TERMINAL
3 LOCKING TANG
4 TOOL J33095

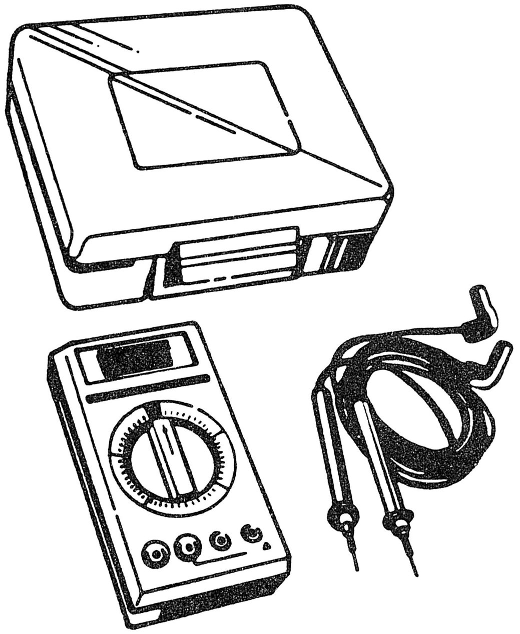
1. GRASP CABLE AND PUSH TERMINAL TO THE MOST FORWARD POSITION.
2. INSERT TOOL J33095 STRAIGHT INTO THE FRONT OF THE CONNECTOR CAVITY. DO NOT USE CONVENTIONAL PICK TO REMOVE TERMINAL.
3. WITH TOOL IN PLACE, GENTLY PULL ON THE CABLE TO REMOVE TERMINAL.
4. VISUALLY CHECK TERMINAL AND REPLACE IF TERMINAL CAVITY OR TANG IS DAMAGED.
5. INSTALL TERMINAL INTO CONNECTOR CAVITY UNTIL LOCKING TANG HAS SNAPPED INTO POSITION.

IS 0562

Figure 7 - Micro-Pack Terminal Replacement

Micro-Pack Connectors

Micro-Pack terminal (Figure 7) replacement requires the use of special tool J 33095, BT-8234-A or equivalent.



HIGH IMPEDANCE MULTIMETER
(DIGITAL VOLTMETER-DVM)
J34029-A

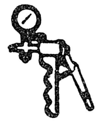
VOLTMETER - Voltage position measures magnitude of voltage when connected in parallel to an existing circuit. A digital voltmeter with a 10 meg ohm input impedance is used because this type of meter will not load down the circuit and result in faulty readings. Some circuits require accurate low voltage readings because they have a very high resistance .

AMMETER - When used as an ammeter, this meter accurately measures extremely low current flow. Refer to meter instructions for more information.

- Selector must be set properly for both function and range. DC is used for most automotive measurements.

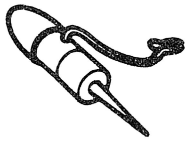
OHMMETER - Measures resistance of circuit directly in ohms. Refer to meter instructions for more information.

- OL display in all ranges indicates open circuit.
- Zero display in all ranges indicates a short circuit.
- An intermittent connection in a circuit may be indicated by a digital reading that will not stabilize on the circuit.
- Range Switch.
  ☐200Ω – Reads ohms directly
  2K,20K,200KΩ – Reads ohms in thousands
  2M and 20MΩ - Reads ohms in millions



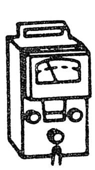
J23738

VACUUM PUMP WITH GAGE (20 IN. HG. MINIMUM)
Use the gage to monitor manifold engine vacuum and use the hand pump to check vacuum sensors, solenoids and valves.



J34142-A

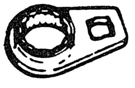
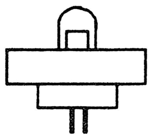
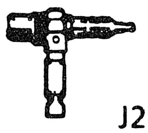
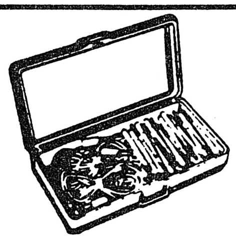
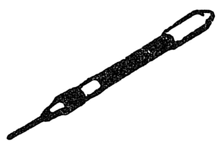
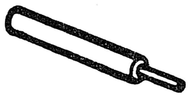
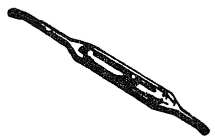
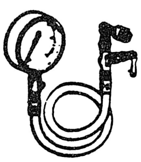
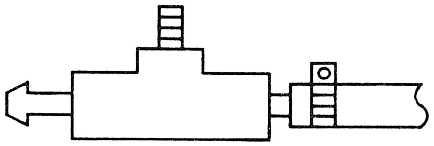
UNPOWERED TEST LIGHT
Used for checking wiring for complete circuit, short to ground, or voltage.



TACHOMETER
Must have inductive trigger signal pickup.

7S 3382

Special Tools

 J29533A/BT8127	**OXYGEN SENSOR WRENCH** Used for removing or installing the oxygen sensor.
 J34730-2B	**INJECTOR TEST LIGHT** Used for checking the electrical circuit to a TBI fuel injector and a port fuel injector.
 J26792/BT7220-1	**SPARK TESTER** Used for checking available secondary ignition voltage. Also called an ST125.
 J35616	**CONNECTOR TEST ADAPTER KIT** Used for making electrical test connections in current Weather Pack, Metri-Pack and Micro-Pack style terminals.
 J35689	**METRI-PACK TERMINAL REMOVER** Used for removing 150 series Metri-Pack "pull-to-seat" terminals from connectors. Refer to wiring harness service in Section "6E" for removal procedure.
 J28742/BT8234-A	**WEATHER PACK TERMINAL REMOVER** Used for removing terminals from Weather Pack connectors. Refer to wiring harness service in Section "6E" for removal procedure.
 J33095/BT8234-A	**ECM CONNECTOR TERMINAL REMOVER** Used for removing terminals from Micro-Pack connectors. Refer to wiring harness service Section "6E" for removal procedure.
 J34730-1	**FUEL PRESSURE GAGE** Used to check and monitor fuel line pressure of Port and Metro TBI fuel system. Part of Diagnostic Kit / J34730-A
 J34730-75	**T-FITTING ADAPTER** Use to adapt J34730-1 fuel pressure gage to Metro TBI fuel system.

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Special Tools

GENERAL SPECIFICATIONS

Many of the specifications used in this section are located on the Vehicle Emission Control Information label under the hood.

Listed on the chart below are locations of specifications used in this Section.

SPECIFICATION	LOCATION OF INFORMATION
Engine Timing	Vehicle Emission Control information label.
Idle Speed, ECM Controlled	Not adjustable. ECM controls idle.
Spark Plug Type	Owner's Manual, Section "7".
Spark Plug Gap	Vehicle Emission Control Information Label.
Engine Code	8th digit of VIN number. Also Owner's Manual, Section "7".
Engine Family	Vehicle Emission Control Information label.
Filter Part Numbers	Owner's Manual, Section "7".
Part Numbers of Major Components	GMSPO Parts Book.
Replacement of Vehicle Emission Control Information Label	GMSPO Label Catalog.

SECTION 6E2

DRIVEABILITY AND EMISSIONS FUEL INJECTION (TBI)

THIS SECTION APPLIES TO:

1.0L (VIN 6) "M" CARLINE (TBI)

CONTENTS

SECTION A Engine Components/Wiring Diagrams/Diagnostic Charts ...... 1.0L (VIN 6) 6E2-A-1
SECTION B Symptoms .... 1.0L (VIN 6) 6E2-B-1
SECTION C Component Systems .... 1.0L (VIN 6) 6E2-C-1
C1 Electronic Control Module (ECM) and Sensors .... 1.0L (VIN 6) 6E2-C1-1
C2 Fuel Metering System .... 1.0L (VIN 6) 6E2-C2-1
C3 Evaporative Emission Control System (EECS) .... 1.0L (VIN 6) 6E2-C3-1
C4 Ignition System .... 1.0L (VIN 6) 6E2-C4-1
C7 Exhaust Gas Recirculation (EGR) System .... 1.0L (VIN 6) 6E2-C7-1
C8 Manual Transaxle (M/T) Shift Light .... 1.0L (VIN 6) 6E2-C8-1
C13 Positive Crankcase Ventilation (PCV) System .... 1.0L (VIN 6) 6E2-C13-1
INDEX .... END OF SECTION

ALL NEW GENERAL MOTORS VEHICLES ARE CERTIFIED BY THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY AS CONFORMING TO THE REQUIREMENTS OF THE REGULATIONS FOR THE CONTROL OF AIR POLLUTION FROM NEW MOTOR VEHICLES. THIS CERTIFICATION IS CONTINGENT ON CERTAIN ADJUSTMENTS BEING SET TO FACTORY STANDARDS. IN MOST CASES, THESE ADJUSTMENT POINTS EITHER HAVE BEEN PERMANENTLY SEALED AND/OR MADE INACCESSIBLE TO PREVENT INDISCRIMINATE OR ROUTINE ADJUSTMENT IN THE FIELD. FOR THIS REASON, THE FACTORY PROCEDURE FOR TEMPORARILY REMOVING PLUGS, CAPS, ETC., FOR PURPOSES OF SERVICING THE PRODUCT, MUST BE STRICTLY FOLLOWED AND, WHEREVER PRACTICABLE, RETURNED TO THE ORIGINAL INTENT OF THE DESIGN.

INTRODUCTION

GENERAL DESCRIPTION

This section applies to engines which have a fuel injector mounted above a throttle body assembly. The entire assembly is mounted to the intake manifold and is referred to as "Throttle Body Injection".

These engines have controls to reduce exhaust emissions, while maintaining good driveability and fuel economy.

An Engine Control Module (ECM) is the heart of this control system and has sensors used to provide information about engine operation and the various systems it controls. Details of basic operation, diagnosis, functional checks, and on-vehicle service are covered in Section "C", Component Systems.

The ECM has the ability to do some diagnosis of itself, and of other parts of the system. When it finds a problem, it lights a "Check Engine" light on the instrument panel and a trouble code will be stored in the ECM memory. This does not mean that the engine should be stopped right away, but that the cause of the light coming "ON" should be checked as soon as reasonably possible.

The EFI system in this car supplies the combustion chambers with air/fuel mixture of optimized ratio under widely varying driving conditions. It uses the single-point throttle body injection system which injects fuel into the throttle body through one injector.

This system has 2 major sub-systems: air/fuel delivery system and electronic control system. Air/fuel delivery system includes fuel pump, throttle body, etc. Electronic control system includes ECM, various sensors and controlled devices.

This section explains the system related to the electronic fuel injection as well as such functions of ECM as listed below.

- EGR control system equipped in METRO model with ESA Ignition System, and Metro LSI model.
- Shift-up indicator light control system equipped in only M/T model.
- Throttle valve opening signal output for A/T model.
- ESA (Electronic Spark Advance) system equipped in METRO model without Vacuum Advance.

ELECTRONIC CONTROL SYSTEM

The electronic control system consists of 1) various sensors which detect the state of engine and driving conditions, 2) ECM which controls various devices according to the signals from the sensors and 3) various controlled devices.

Functionally, it is divided into six sub-systems:

- Fuel injection control system.
- ISC solenoid valve control system.
- Fuel pump control system.
- EGR control system.
- Shift-up indicator light control system (For M/T model only).
- Electronic Spark Advance (ESA) system (For METRO without vacuum advance).

Also, with A/T model ECM sends throttle valve opening signal to A/T control module to control A/T.

DIAGNOSIS PROCEDURE

ECM has a system self-diagnosis function to help with diagnosing failures which effect vehicle performance.

Investigate where the trouble is by referring to "Diagnostic Flow Chart" and "Diagnostic Code" in this section.

PRECAUTIONS IN DIAGNOSING TROUBLES IN EFI SYSTEM

- Before identifying diagnostic code indicated by "Check Engine" light, don't disconnect connectors from ECM, battery cable from battery, ECM ground wire harness from engine, main fuse (60A) or 15A fuse for tail light circuit. Such disconnection will erase memorized trouble in ECM memory.
- If abnormality or malfunction lies in two or more areas, "Check Engine" light indicates applicable codes three times each. And flashing of these codes is repeated as long as diagnosis terminal is grounded (spare fuse is connected) and ignition switch is held at "ON" position.
- Take a note of diagnostic code indicated first.
- Intermittent troubles - There are cases where "Check Engine" light indicates a diagnostic code representing a trouble which occurred only temporarily and has gone. In such case, it may occur that good parts are replaced unnecessarily. To prevent such an accident, be sure to follow instructions given below when checking by using "Diagnostic Flow Chart".
  - When trouble can be identified, that is, it is not an intermittent one:
    Check sensor (actuator), wires and each connection and if they are all in good condition, follow all procedures on the diagnostic chart.
  - When trouble can not be identified but "Check Engine" light indicates a trouble code:
    Diagnose trouble by using that code No. and if sensor (actuator), wires and each connection are all in good condition, erase diagnostic code in ECM memory. Then conduct a test run and check what "Check Engine" light indicates. Only when it indicates trouble code again, replace the ECM and recheck.
    If it indicates not trouble code but normal code No. 12, it means that an intermittent trouble did occur and has gone. In this case, check wires and connections carefully again.

NOTES ON SYSTEM CIRCUIT INSPECTION

- Intermittent troubles - Most intermittent problems are caused by faulty electrical connections or wiring.
  Perform careful check of suspect circuits for:
  - Poor mating of connector halves, or terminals not fully seated in connector body (backed out).
  - Improperly formed or damaged terminals. All connector terminals in problem circuit should be carefully reformed to increase contact tension.
  - Poor terminal to wire connection.
- Never connect any tester (voltmeter, ohmmeter, or whatever) to ECM when its connector is disconnected. Attempt to do it may cause damage to ECM.
- Never connect an ohmmeter to ECM with its connector connected to it. Attempt to do it may cause damage to ECM and sensors.
- Be sure to use a voltmeter whose inner resistance is more than one MΩ per 1V or a digital type voltmeter. Any other voltmeter should not be used because accurate measurements are not obtained.
- When checking voltage at each terminal of the connector which is connected to ECM, be sure to connect negative probe to body ground and using service wire, connect ECM case to body ground.
  Applying probes of voltmeter improperly may cause the sensor or ECM to be shorted and damaged.

The following section(s) are written for specific engine applications and are clearly identified. Be sure to use only the section which applies to the engine family being diagnosed.

Before using this section of the manual, you should be familiar with the information and the proper diagnosing procedures as described in Section "6E". If the proper diagnosis procedures are not followed, as described in Section "6E", it may result in unnecessary replacement of good parts.

Trouble Tree charts incorporate diagnostic procedures using a Digital Volt Ohm Meter and a test light.

SECTION A

1.0L (VIN 6) "M" CARLINE (TBI)

DIAGNOSTIC CIRCUIT CHECK

The "Diagnostic Circuit Check" verifies that the engine control system is functioning correctly. Special considerations to observe while performing the "Diagnostic Circuit Check" are:

Blocking Drive Wheels

The vehicle drive wheels should always be blocked while checking the system.

Cold Oxygen Sensor

The system oxygen sensor may cool off after only a short period of operation at idle. This will cause the system to enter "Open Loop" operation. Run the engine at part throttle until "Closed Loop" operation is restored.

BASIC PROCEDURE

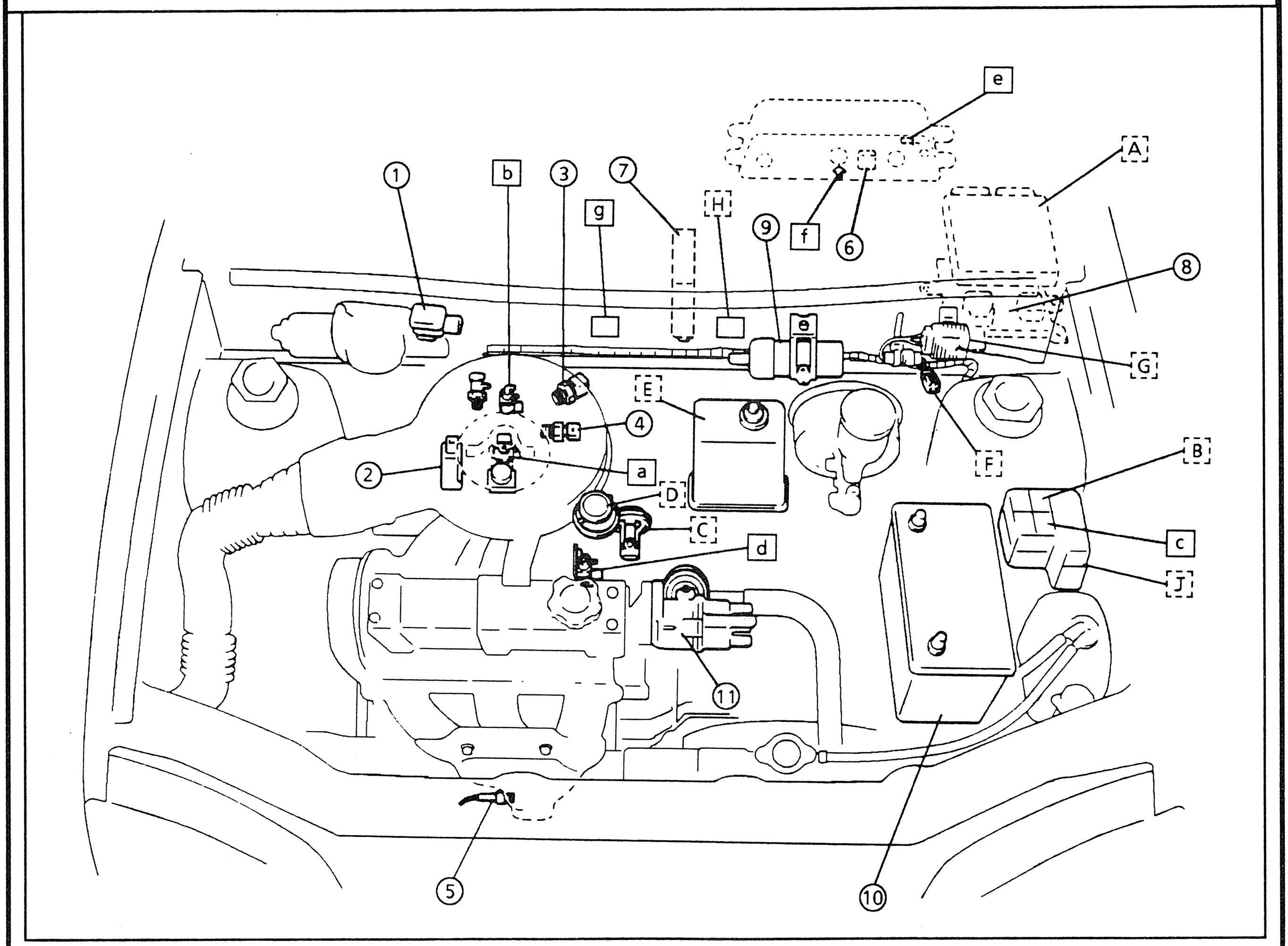
If the basic information on using the diagnostic procedures contained in this section has not been reviewed, refer to the introduction of this section.

SECTION A

ENGINE COMPONENTS / WIRING DIAGRAMS / DIAGNOSTIC CHARTS

Component Locations .... **Page A-2**
ECM Wiring Diagrams .... **Page A-3**
ECM Terminal End Views .... **Page A-9**
EFI System .... **Page A-12**
Diagnostic Code Table .... **Page A-16**
Diagnostic Circuit Check .... **Page A-17**
No "Check Engine" Light - Chart A-1 .... **Page A-18**
Won't Flash Code 12 - "Check Engine" Light "ON" Steady - Chart A-2 .... **Page A-20**
Engine Cranks But Will Not Run - Chart A-3
  LSI Conventional Ignition System (With Vacuum Advance) .... **Page A-22**
  ESA Ignition System (Without Vacuum Advance) .... **Page A-24**
Engine Cranks But Will Not Run (Fuel System Electrical Test) - Chart A-5 .... **Page A-26**
Fuel System Pressure Test - Chart A-7 .... **Page A-28**
Fuel System Pressure Test (Fuel Pressure Gage Installation) - Chart A-7 .... **Page A-32**
Code 13 - Oxygen Sensor Circuit (Open Circuit) .... **Page A-34**
Code 14 - Coolant Temperature Sensor (CTS) Circuit (High Temperature Indicated) .... **Page A-36**
Code 15 - Coolant Temperature Sensor (CTS) Circuit (Low Temperature Indicated) .... **Page A-38**
Code 21 - Throttle Switch Circuit - M/T only
  (Both Idle Switch and Wide Open Throttle Switch Indicated "ON") .... **Page A-40**
Code 21 - Throttle Position Sensor (TPS) Circuit - A/T only (Signal Voltage High) .... **Page A-42**
Code 22 - Throttle Position Sensor (TPS) Circuit - A/T only (Signal Voltage Low) .... **Page A-44**
Code 23 - Manifold Air Temperature (MAT) Sensor Circuit (Low Temperature Indicated) .... **Page A-46**
Code 24 - Vehicle Speed Sensor (VSS) Circuit .... **Page A-48**
Code 25 - Manifold Air Temperature (MAT) Sensor Circuit (High Temperature Indicated) .... **Page A-50**
Code 31 - Manifold Absolute Pressure (MAP) Sensor Circuit (Signal Voltage Low - High Vacuum) **Page A-52**
Code 32 - Manifold Absolute Pressure (MAP) Sensor Circuit (Signal Voltage High - Low Vacuum) **Page A-54**
Code 41 - Ignition Signal Circuit
  LSI Conventional Ignition System (With Vacuum Advance) .... **Page A-56**
Code 41 - Ignition Signal Circuit (No Signal)
  ESA Ignition System (Without Vacuum Advance) .... **Page A-58**
Code 42 - Crank Angle Sensor Circuit (No Signal For 2 Seconds)
  ESA Ignition System (Without Vacuum Advance) .... **Page A-60**
Code 51 - Exhaust Gas Recirculation (EGR) Circuit
  (California Emissions Systems Only) .... **Page A-62**

1.0L (VIN 6) "M" CARLINE



○ **INFORMATION SENSORS**

1. MAP
2. TS or TPS
3. MAT
4. CTS
5. Oxygen sensor
6. Speed sensor
7. A/T control module (For A/T model)
8. Passenger compartment fuse block (Diagnosis switch terminal)
9. Ignition coil
10. Battery
11. Distributor

□ **CONTROLLED DEVICES**

a: Fuel injector
b: ISC solenoid valve
c: Fuel pump relay
d: EGR VSV*
e: "CHECK ENGINE" light
f: Shift Light (For M/T model)
g: A/C VSV (If equipped)

⬚ **NOT ECM CONNECTED**

A: ECM
B: EFI main relay
C: EGR modulator*
D: EGR valve*
E: Canister
F: Monitor coupler
G: Injector resistor
H: A/C Amplifier
J: Engine compartment relay/fuse block

* CALIFORNIA ONLY

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Figure A-1 - Component Locations 1.0L (VIN 6) "M" Carline

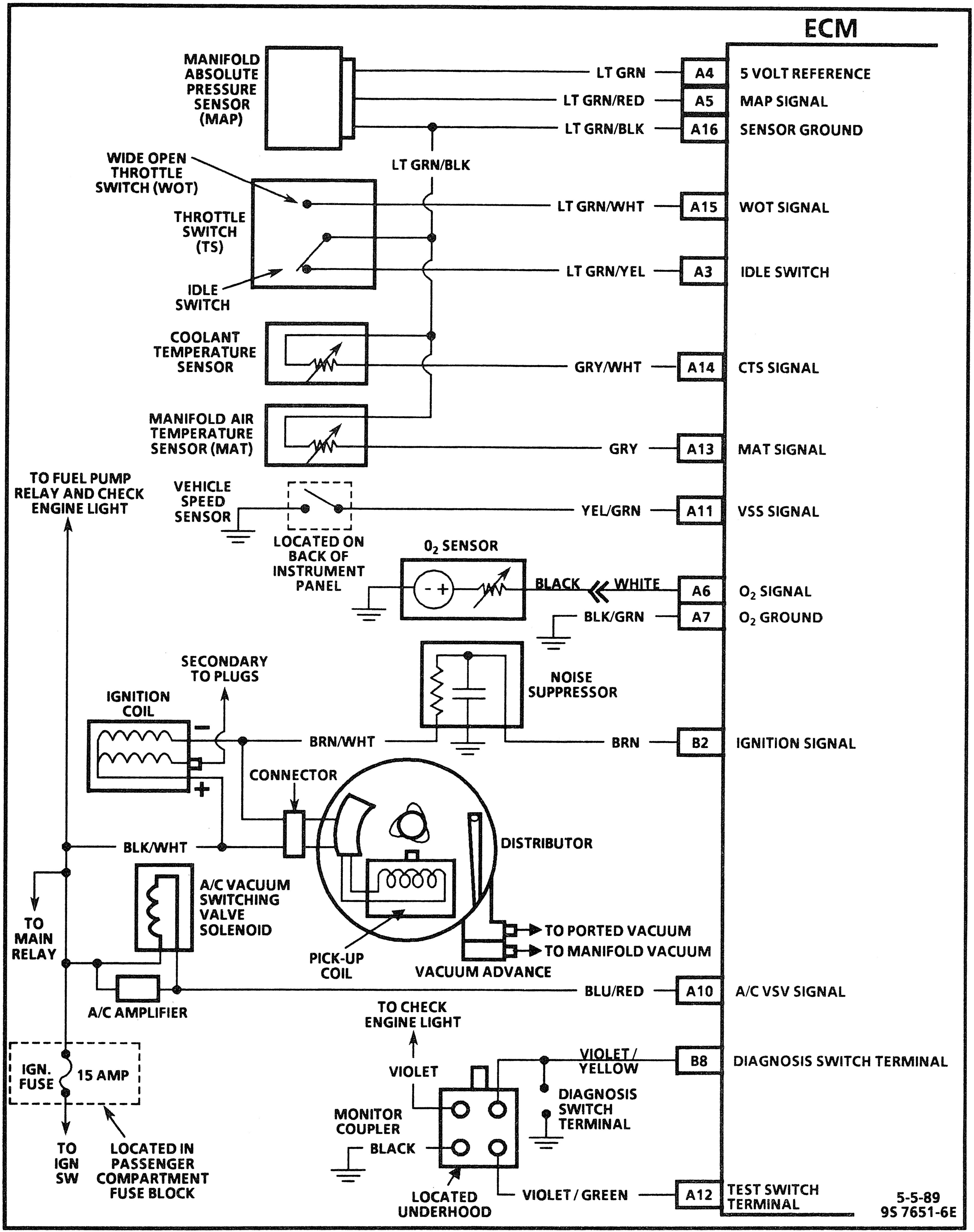

ECM
MANIFOLD ABSOLUTE PRESSURE SENSOR (MAP)
LT GRN
A4
5 VOLT REFERENCE
LT GRN/RED
A5
MAP SIGNAL
LT GRN/BLK
A16
SENSOR GROUND
LT GRN/BLK
WIDE OPEN THROTTLE SWITCH (WOT)
THROTTLE SWITCH (TS)
LT GRN/WHT
A15
WOT SIGNAL
LT GRN/YEL
A3
IDLE SWITCH
IDLE SWITCH
COOLANT TEMPERATURE SENSOR
GRY/WHT
A14
CTS SIGNAL
MANIFOLD AIR TEMPERATURE SENSOR (MAT)
GRY
A13
MAT SIGNAL
TO FUEL PUMP RELAY AND CHECK ENGINE LIGHT
VEHICLE SPEED SENSOR
YEL/GRN
A11
VSS SIGNAL
LOCATED ON BACK OF INSTRUMENT PANEL
O2 SENSOR
BLACK
WHITE
A6
O2 SIGNAL
BLK/GRN
A7
O2 GROUND
NOISE SUPPRESSOR
SECONDARY TO PLUGS
IGNITION COIL
BRN/WHT
BRN
B2
IGNITION SIGNAL
CONNECTOR
DISTRIBUTOR
BLK/WHT
A/C VACUUM SWITCHING VALVE SOLENOID
TO MAIN RELAY
TO PORTED VACUUM
TO MANIFOLD VACUUM
PICK-UP COIL
VACUUM ADVANCE
BLU/RED
A10
A/C VSV SIGNAL
A/C AMPLIFIER
TO CHECK ENGINE LIGHT
VIOLET/YELLOW
B8
DIAGNOSIS SWITCH TERMINAL
VIOLET
DIAGNOSIS SWITCH TERMINAL
IGN. FUSE
15 AMP
MONITOR COUPLER
BLACK
TO IGN SW
LOCATED IN PASSENGER COMPARTMENT FUSE BLOCK
LOCATED UNDERHOOD
VIOLET / GREEN
A12
TEST SWITCH TERMINAL
5-5-89
9S 7651-6E

Figure A-2 - ECM Wiring Diagram - Metro LSI with Conventional Ignition System (With Vacuum Advance) Manual Transaxle (M/T) - (1 of 2) 1.0L (VIN 6) "M" Carline

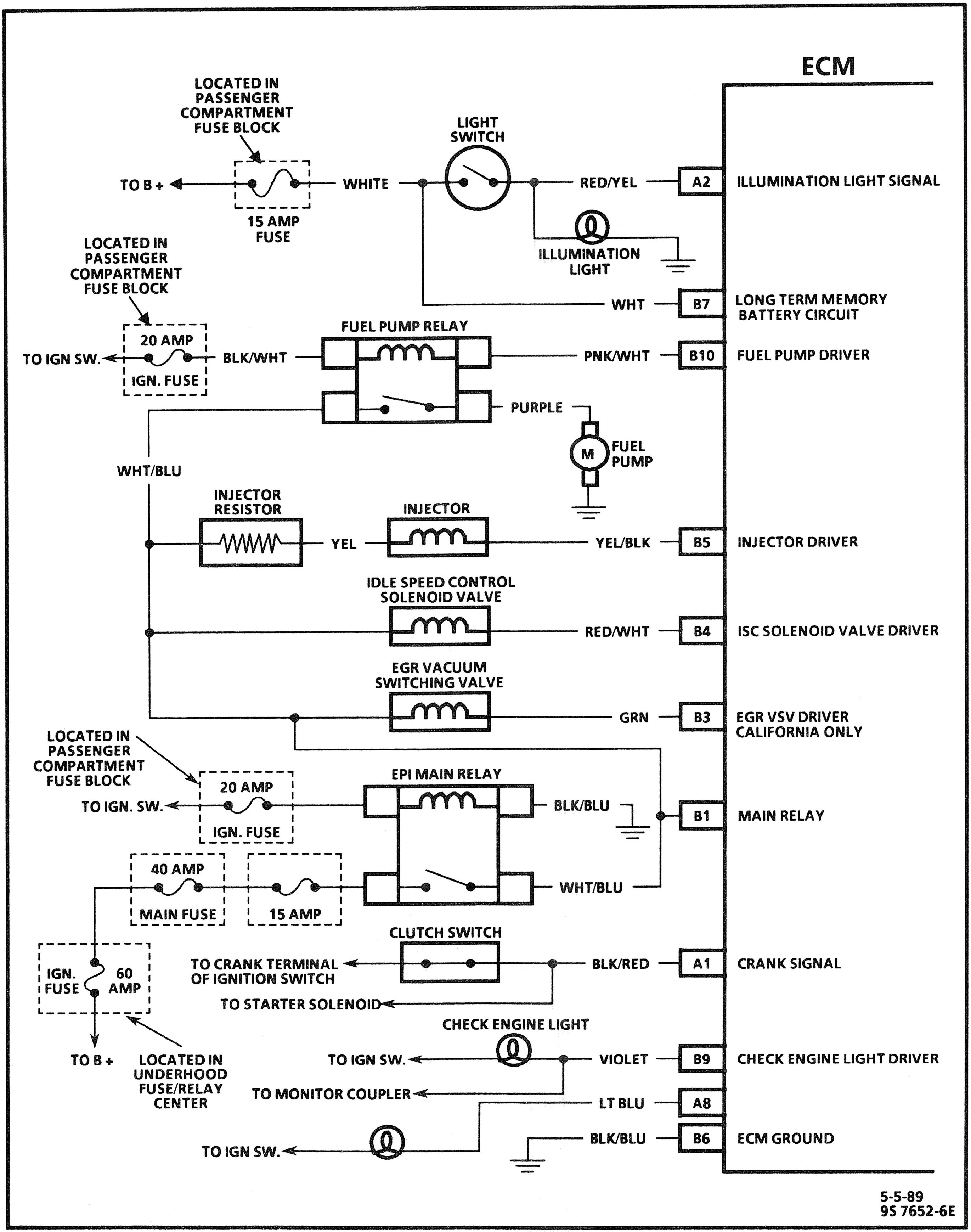
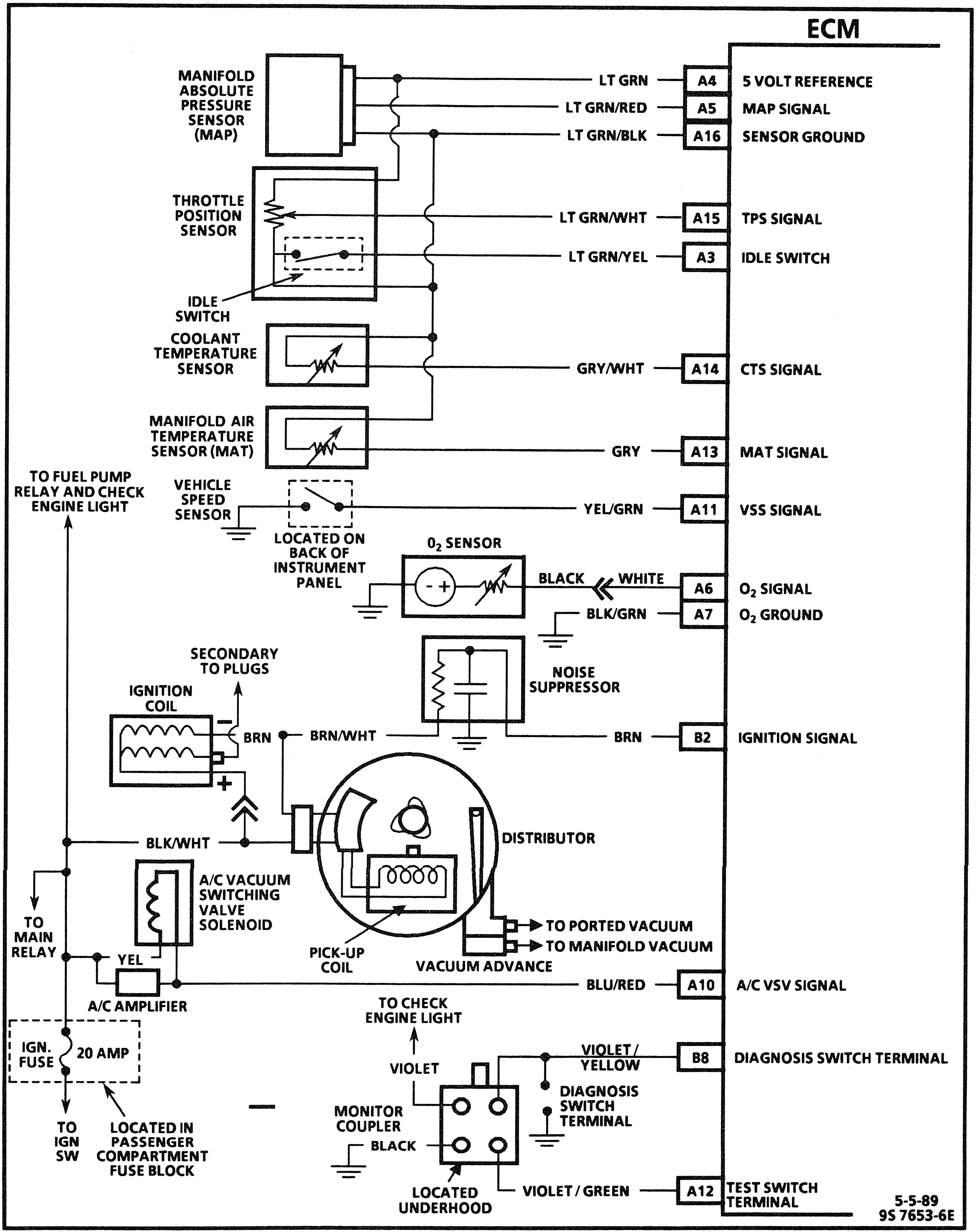
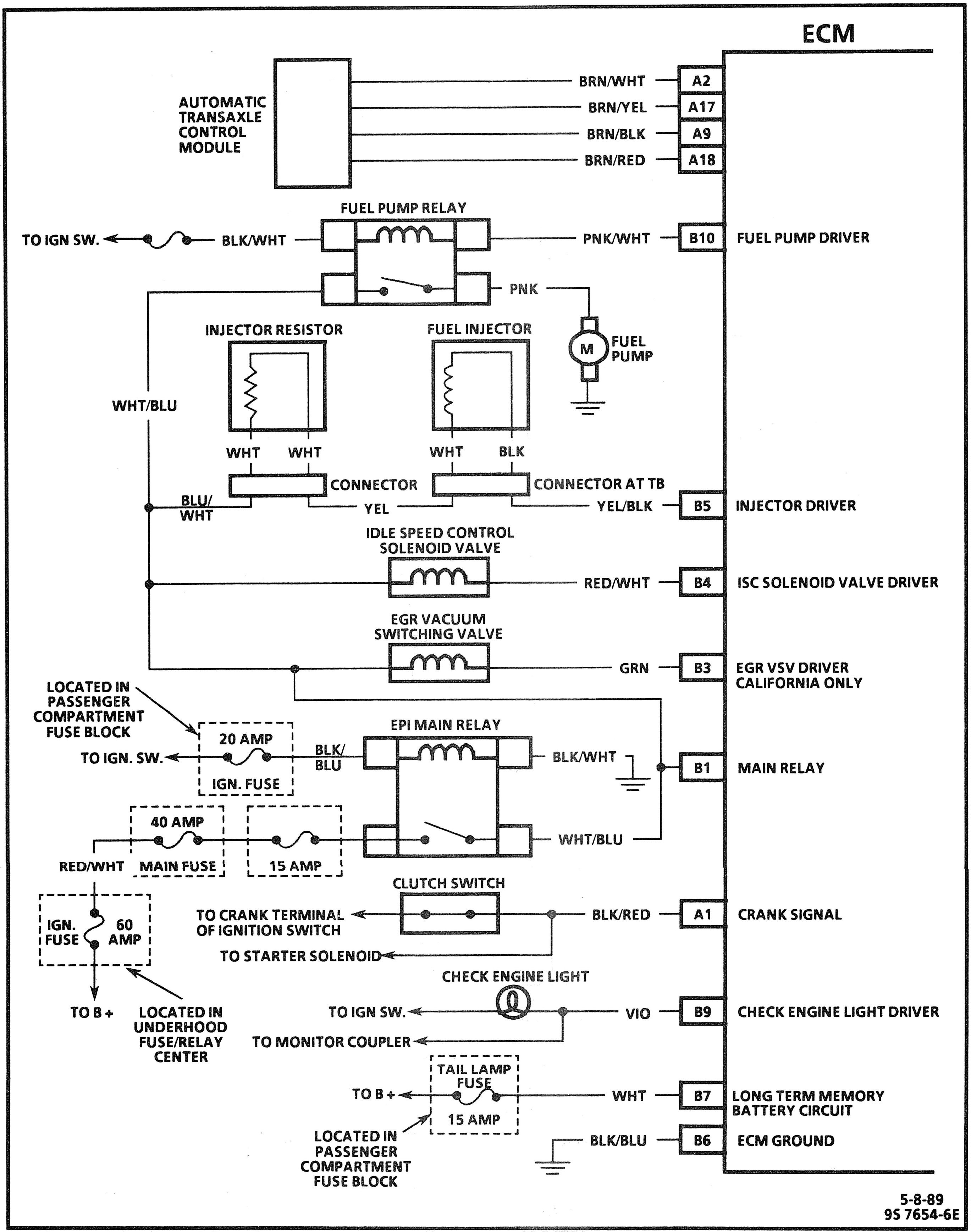

ECM
LOCATED IN PASSENGER COMPARTMENT FUSE BLOCK
LIGHT SWITCH
TO B+
WHITE
RED/YEL
A2
ILLUMINATION LIGHT SIGNAL
15 AMP FUSE
ILLUMINATION LIGHT
LOCATED IN PASSENGER COMPARTMENT FUSE BLOCK
WHT
B7
LONG TERM MEMORY BATTERY CIRCUIT
FUEL PUMP RELAY
20 AMP
TO IGN SW.
BLK/WHT
IGN. FUSE
PNK/WHT
B10
FUEL PUMP DRIVER
PURPLE
M
FUEL PUMP
WHT/BLU
INJECTOR RESISTOR
INJECTOR
YEL
YEL/BLK
B5
INJECTOR DRIVER
IDLE SPEED CONTROL SOLENOID VALVE
RED/WHT
B4
ISC SOLENOID VALVE DRIVER
EGR VACUUM SWITCHING VALVE
GRN
B3
EGR VSV DRIVER CALIFORNIA ONLY
LOCATED IN PASSENGER COMPARTMENT FUSE BLOCK
EPI MAIN RELAY
20 AMP
TO IGN. SW.
IGN. FUSE
BLK/BLU
B1
MAIN RELAY
40 AMP
MAIN FUSE
15 AMP
WHT/BLU
CLUTCH SWITCH
IGN. FUSE
60 AMP
TO CRANK TERMINAL OF IGNITION SWITCH
BLK/RED
A1
CRANK SIGNAL
TO STARTER SOLENOID
CHECK ENGINE LIGHT
TO B+
LOCATED IN UNDERHOOD FUSE/RELAY CENTER
TO IGN SW.
VIOLET
B9
CHECK ENGINE LIGHT DRIVER
TO MONITOR COUPLER
LT BLU
A8
TO IGN SW.
BLK/BLU
B6
ECM GROUND
5-5-89
9S 7652-6E

Figure A-3 - ECM Wiring Diagram - Metro LSI with Conventional Ignition System (With Vacuum Advance) Manual Transaxle (M/T) - (2 of 2) 1.0L (VIN 6) "M" Carline


ECM
MANIFOLD ABSOLUTE PRESSURE SENSOR (MAP)
LT GRN
A4
5 VOLT REFERENCE
LT GRN/RED
A5
MAP SIGNAL
LT GRN/BLK
A16
SENSOR GROUND
THROTTLE POSITION SENSOR
LT GRN/WHT
A15
TPS SIGNAL
LT GRN/YEL
A3
IDLE SWITCH
IDLE SWITCH
COOLANT TEMPERATURE SENSOR
GRY/WHT
A14
CTS SIGNAL
MANIFOLD AIR TEMPERATURE SENSOR (MAT)
GRY
A13
MAT SIGNAL
TO FUEL PUMP RELAY AND CHECK ENGINE LIGHT
VEHICLE SPEED SENSOR
LOCATED ON BACK OF INSTRUMENT PANEL
YEL/GRN
A11
VSS SIGNAL
0_2 SENSOR
BLACK
WHITE
A6
O_2 SIGNAL
BLK/GRN
A7
O_2 GROUND
SECONDARY TO PLUGS
IGNITION COIL
NOISE SUPPRESSOR
BRN
BRN/WHT
BRN
B2
IGNITION SIGNAL
DISTRIBUTOR
BLK/WHT
A/C VACUUM SWITCHING VALVE SOLENOID
TO MAIN RELAY
YEL
PICK-UP COIL
TO PORTED VACUUM
TO MANIFOLD VACUUM
VACUUM ADVANCE
A/C AMPLIFIER
BLU/RED
A10
A/C VSV SIGNAL
TO CHECK ENGINE LIGHT
IGN. FUSE
20 AMP
VIOLET
VIOLET/YELLOW
B8
DIAGNOSIS SWITCH TERMINAL
DIAGNOSIS SWITCH TERMINAL
MONITOR COUPLER
BLACK
TO IGN SW
LOCATED IN PASSENGER COMPARTMENT FUSE BLOCK
LOCATED UNDERHOOD
VIOLET/GREEN
A12
TEST SWITCH TERMINAL

5-5-89
9S 7653-6E

Figure A-4 - ECM Wiring Diagram - Metro LSI with Conventional Ignition System (With Vacuum Advance) Automatic Transaxle (A/T) - (1 of 2) 1.0L (VIN 6) "M" Carline


ECM
AUTOMATIC TRANSAXLE CONTROL MODULE
BRN/WHT
A2
BRN/YEL
A17
BRN/BLK
A9
BRN/RED
A18
FUEL PUMP RELAY
TO IGN SW.
BLK/WHT
PNK/WHT
B10
FUEL PUMP DRIVER
PNK
INJECTOR RESISTOR
FUEL INJECTOR
M
FUEL PUMP
WHT/BLU
WHT
WHT
WHT
BLK
CONNECTOR
CONNECTOR AT TB
BLU/WHT
YEL
YEL/BLK
B5
INJECTOR DRIVER
IDLE SPEED CONTROL SOLENOID VALVE
RED/WHT
B4
ISC SOLENOID VALVE DRIVER
EGR VACUUM SWITCHING VALVE
GRN
B3
EGR VSV DRIVER CALIFORNIA ONLY
LOCATED IN PASSENGER COMPARTMENT FUSE BLOCK
20 AMP
TO IGN. SW.
IGN. FUSE
EPI MAIN RELAY
BLK/BLU
BLK/WHT
B1
MAIN RELAY
40 AMP
MAIN FUSE
15 AMP
RED/WHT
WHT/BLU
IGN. FUSE
60 AMP
TO B+
LOCATED IN UNDERHOOD FUSE/RELAY CENTER
CLUTCH SWITCH
TO CRANK TERMINAL OF IGNITION SWITCH
TO STARTER SOLENOID
BLK/RED
A1
CRANK SIGNAL
CHECK ENGINE LIGHT
TO IGN SW.
TO MONITOR COUPLER
VIO
B9
CHECK ENGINE LIGHT DRIVER
TAIL LAMP FUSE
15 AMP
TO B+
LOCATED IN PASSENGER COMPARTMENT FUSE BLOCK
WHT
B7
LONG TERM MEMORY BATTERY CIRCUIT
BLK/BLU
B6
ECM GROUND

5-8-89
9S 7654-6E

Figure A-5 - ECM Wiring Diagram - Metro LSI with Conventional Ignition System (With Vacuum Advance) Automatic Transaxle (A/T) - (2 of 2) 1.0L (VIN 6) "M" Carline

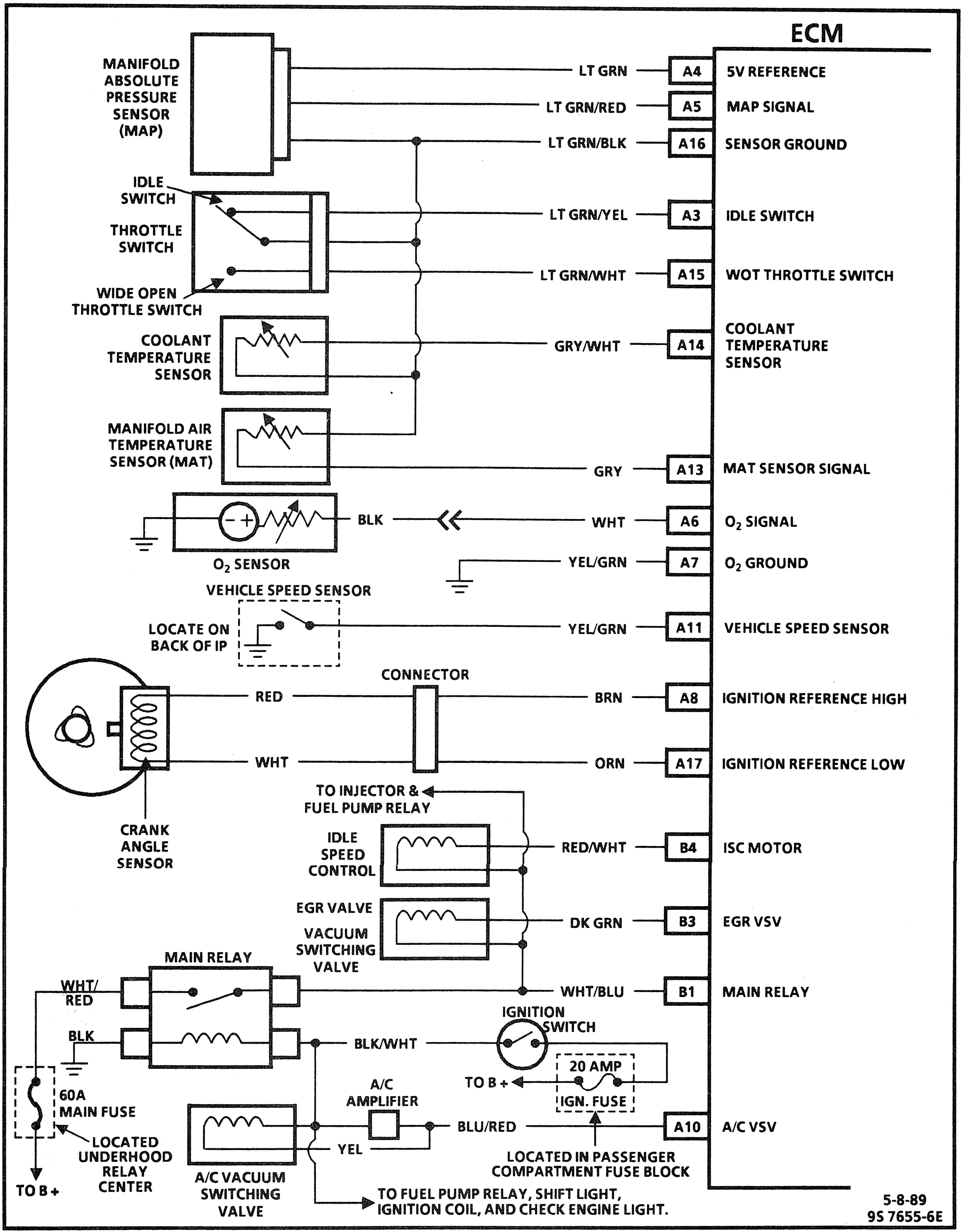

ECM
MANIFOLD ABSOLUTE PRESSURE SENSOR (MAP)
LT GRN
A4
5V REFERENCE
LT GRN/RED
A5
MAP SIGNAL
LT GRN/BLK
A16
SENSOR GROUND
IDLE SWITCH
THROTTLE SWITCH
LT GRN/YEL
A3
IDLE SWITCH
WIDE OPEN THROTTLE SWITCH
LT GRN/WHT
A15
WOT THROTTLE SWITCH
COOLANT TEMPERATURE SENSOR
GRY/WHT
A14
COOLANT TEMPERATURE SENSOR
MANIFOLD AIR TEMPERATURE SENSOR (MAT)
GRY
A13
MAT SENSOR SIGNAL
BLK
WHT
A6
O2 SIGNAL
O2 SENSOR
YEL/GRN
A7
O2 GROUND
VEHICLE SPEED SENSOR
LOCATE ON BACK OF IP
YEL/GRN
A11
VEHICLE SPEED SENSOR
CONNECTOR
RED
BRN
A8
IGNITION REFERENCE HIGH
WHT
ORN
A17
IGNITION REFERENCE LOW
CRANK ANGLE SENSOR
TO INJECTOR & FUEL PUMP RELAY
IDLE SPEED CONTROL
RED/WHT
B4
ISC MOTOR
EGR VALVE VACUUM SWITCHING VALVE
DK GRN
B3
EGR VSV
MAIN RELAY
WHT/RED
WHT/BLU
B1
MAIN RELAY
BLK
BLK/WHT
IGNITION SWITCH
20 AMP IGN. FUSE
TO B+
60A MAIN FUSE
LOCATED UNDERHOOD RELAY CENTER
TO B+
A/C AMPLIFIER
BLU/RED
A10
A/C VSV
YEL
A/C VACUUM SWITCHING VALVE
LOCATED IN PASSENGER COMPARTMENT FUSE BLOCK
TO FUEL PUMP RELAY, SHIFT LIGHT, IGNITION COIL, AND CHECK ENGINE LIGHT.
5-8-89
9S 7655-6E

Figure A-6 - ECM Wiring Diagram - Metro with ESA Ignition System (Without Vacuum Advance) Manual Transaxle (M/T) - (1 of 2) 1.0L (VIN 6) "M" Carline

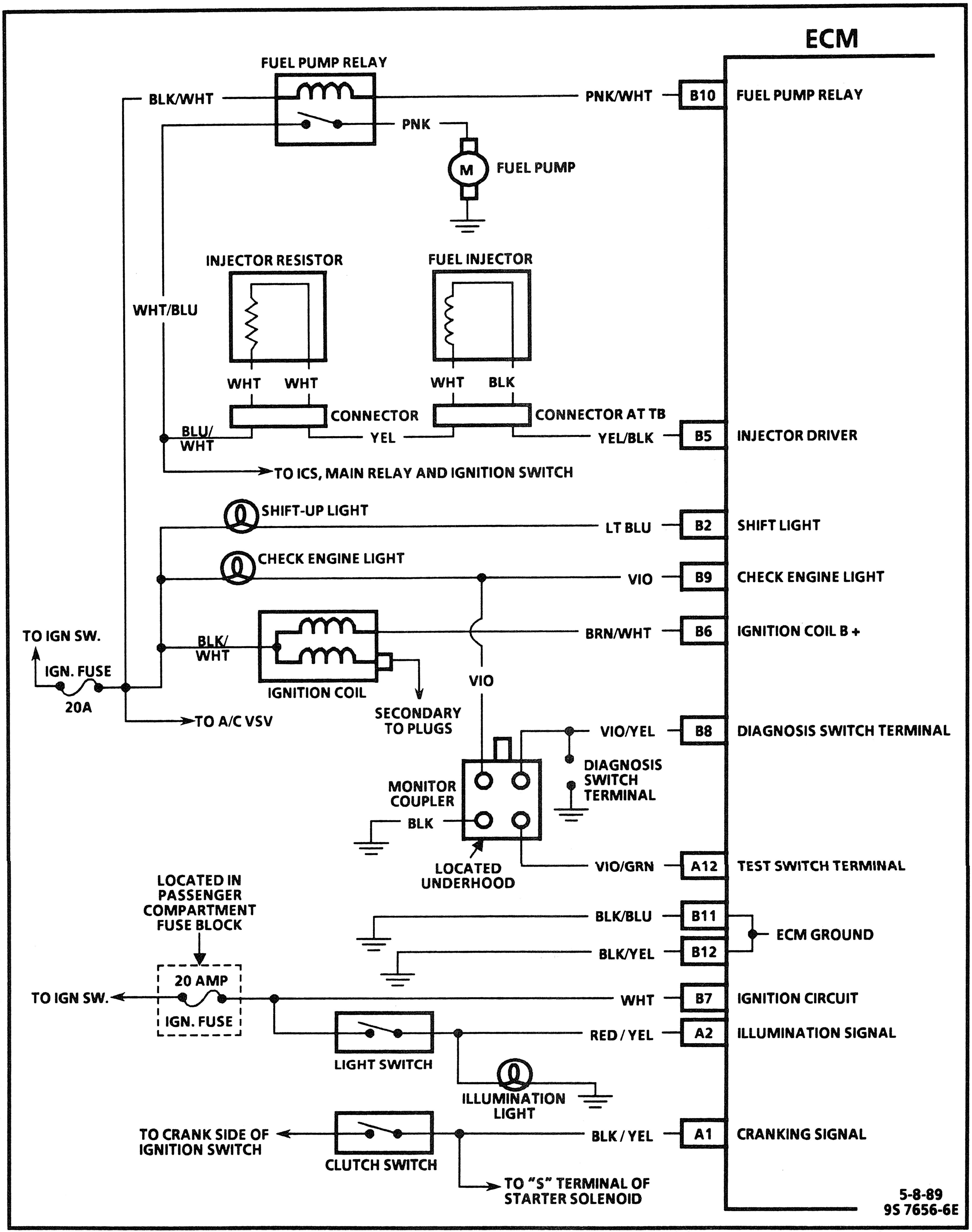

ECM
FUEL PUMP RELAY
BLK/WHT
PNK/WHT
B10
FUEL PUMP RELAY
PNK
M
FUEL PUMP
INJECTOR RESISTOR
FUEL INJECTOR
WHT/BLU
WHT
WHT
WHT
BLK
CONNECTOR
CONNECTOR AT TB
BLU/
WHT
YEL
YEL/BLK
B5
INJECTOR DRIVER
TO ICS, MAIN RELAY AND IGNITION SWITCH
SHIFT-UP LIGHT
LT BLU
B2
SHIFT LIGHT
CHECK ENGINE LIGHT
VIO
B9
CHECK ENGINE LIGHT
TO IGN SW.
BLK/
WHT
BRN/WHT
B6
IGNITION COIL B +
IGN. FUSE
20A
IGNITION COIL
VIO
TO A/C VSV
SECONDARY
TO PLUGS
VIO/YEL
B8
DIAGNOSIS SWITCH TERMINAL
MONITOR
COUPLER
DIAGNOSIS
SWITCH
TERMINAL
BLK
LOCATED
UNDERHOOD
VIO/GRN
A12
TEST SWITCH TERMINAL
LOCATED IN
PASSENGER
COMPARTMENT
FUSE BLOCK
BLK/BLU
B11
ECM GROUND
BLK/YEL
B12
20 AMP
TO IGN SW.
IGN. FUSE
WHT
B7
IGNITION CIRCUIT
RED / YEL
A2
ILLUMINATION SIGNAL
LIGHT SWITCH
ILLUMINATION
LIGHT
TO CRANK SIDE OF
IGNITION SWITCH
BLK / YEL
A1
CRANKING SIGNAL
CLUTCH SWITCH
TO "S" TERMINAL OF
STARTER SOLENOID
5-8-89
9S 7656-6E

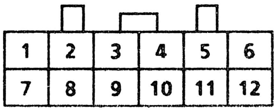
Figure A-7 - ECM Wiring Diagram - Metro with ESA Ignition System (Without Vacuum Advance) Manual Transaxle (M/T) - (2 of 2) 1.0L (VIN 6) "M" Carline

FUEL INJECTION ECM CONNECTOR IDENTIFICATION

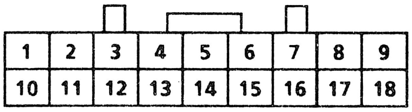
The following ECM voltage charts are for use with a digital voltmeter to further aid in diagnosis. The voltages you get may vary due to low battery charge or other reasons, but they should be very close.

THE FOLLOWING CONDITIONS MUST BE MET BEFORE TESTING:

- Engine at operating temperature
- Engine idling (for "Engine Run" column)
- Test terminal not grounded (except where noted)
- All voltages shown "B + " indicates battery or charging voltage



BACKVIEW ECM CONNECTOR B



BACKVIEW ECM CONNECTOR A

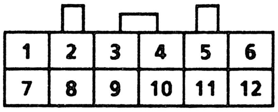
VOLTAGE				
KEY "ON"	ENG. RUN	CIRCUIT	PIN	WIRE COLOR
B +	B +	MAIN RELAY	B1	
		NOT USED	B2	
B +	B +	EGR DRIVER	B3	GREEN
0*	ON * OFF B +	ISC SOLENOID	B4	RED/ WHITE
B +	B +	INJECTOR DRIVER	B5	YELLOW/ BLACK
0*	0*	ECM GROUND	B6	BLACK/ BLUE
B +	B +	LONG TERM BATTERY FEED	B7	WHITE
4 - 5	4 - 5	DIAGNOSIS SWITCH TERMINAL	B8	VIOLET/ YELLOW
0*	B +	CHECK ENGINE LIGHT	B9	VIOLET
B + ③	0*	FUEL PUMP	B10	PINK/ WHITE
		NOT USED	B11	
		NOT USED	B12	

			VOLTAGE		
WIRE COLOR	PIN	CIRCUIT	KEY "ON"	ENG. RUN	
BLACK/ YELLOW	A1	CRANK SIGNAL	6-12V	0V	⑧
RED/ YELLOW	A2	ILLUMINATION LIGHT SIGNAL			⑦
LT GREEN/ YELLOW	A3	IDLE SWITCH SIGNAL	4-5V	4-5V	⑤
LT GREEN	A4	5V REFERENCE	5V	5V	
LT GREEN/ RED	A5	MAP SIGNAL	3 - 5	3 - 5	②
WHITE	A6	O2 SIGNAL	.35 - .45	.1 - .9	
BLACK/ GREEN	A7	O2 GROUND	0*	0*	
LT BLUE	A8	UPSHIFT IND. LAMP LIGHTING SW "OFF"	2-3V	IDLE 10-14V	
		UPSHIFT IND. LAMP LIGHTING SW "ON"	6-7V	IDLE 10-14V	
	A9	NOT USED			
BLUE/ RED	A10	A/C SIGNAL	ON * OFF B +	ON * OFF B +	
YELLOW/ GREEN	A11	VSS SIGNAL			①
VIOLET/ GREEN	A12	TEST SWITCH TERMINAL	4 - 5	4 - 5	
GRAY	A13	MAT SIGNAL	2V	2V	②
GRAY/ WHITE	A14	CTS SIGNAL	.45	.45	⑥
LT GREEN/ WHITE	A15	WOT SIGNAL	4 - 5	4 - 5	④
LT GREEN/ BLACK	A16	SENSOR GROUND	0*	0*	
	A17	NOT USED			
	A18	NOT USED			

0* Less than .5 volts.
① Varies between 6-5 volt with drive wheels turning.
② Varies.
③ B + for first 2 seconds.
④ 0 volts at wide open throttle.
⑤ Off idle position.
⑥ Varies with engine temperature.
⑦ B + with light switch "ON".
⑧ Voltage present only during cranking.

5-5-89
9S 7648-6E

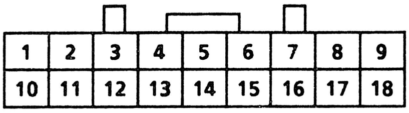
Figure A-8 - ECM Terminal End View - Metro LSI with Conventional Ignition System
Manual Transaxle (M/T) 1.0L (VIN 6) "M" Carline



BACKVIEW ECM CONNECTOR B

VOLTAGE				
KEY "ON"	ENG. RUN	CIRCUIT	PIN	WIRE COLOR
B+	B+	MAIN RELAY	B1	WHITE/ BLUE
B+	②	IGNITION SIGNAL	B2	
B+	B+	EGR DRIVER	B3	GREEN
0*	ON * OFF B+	ISC SOLENOID	B4	RED/ WHITE
B+	B+	INJECTOR DRIVER	B5	YELLOW/ BLACK
0*	0*	ECM GROUND	B6	BLACK/ BLUE
B+	B+	LONG TERM BATTERY FEED	B7	WHITE
4-5	4-5	DIAGNOSIS SWITCH TERMINAL	B8	VIOLET/ YELLOW
0*	B+	CHECK ENGINE LIGHT	B9	VIOLET
B+ ⑤	0*	FUEL PUMP RELAY	B10	PINK/ WHITE
		NOT USED	B11	
		NOT USED	B12	

0* Less than .5 volts.
① Varies from .60 to battery voltage depending on position of drive wheels.
② Varies.
③ Varies with temperature.
⑤ B+ for first 2 seconds.
⑥ California only
⑦ Varies with throttle position.



BACKVIEW ECM CONNECTOR A

			VOLTAGE		
WIRE COLOR	PIN	CIRCUIT	KEY "ON"	ENG. RUN	
BLACK/ RED	A1	CRANK SIGNAL	6-12V	0*	⑦
BRN/WHT	A2	TRANSAXLE	.2-.4V		
LT GREEN/ YELLOW	A3	IDLE SWITCH	0*	0*	
LT GREEN	A4	5V REFERENCE	5.0	5.0	
LT GREEN/ RED	A5	MAP SIGNAL	3-5	4.1	②
WHITE	A6	O_2 SIGNAL	0*	0-1	
BLACK/ GREEN	A7	O_2 GROUND	0*	0*	
	A8	NOT USED			
BROWN/ BLACK	A9	TRANSAXLE	.2-.4V	.2-.4V	
BLUE/ RED	A10	A/C SIGNAL	ON * OFF B+	ON * OFF B+	
YELLOW/ GREEN	A11	VSS SIGNAL	0*	4-5	①
VIOLET/ GREEN	A12	TEST SWITCH TERMINAL	4-5	4-5	
GRAY	A13	MAT SIGNAL	2.0	2.0	③
GRAY/ WHITE	A14	CTS SIGNAL	.45	.45	③
LT GREEN/ WHITE	A15	TPS SIGNAL			②
LT GREEN/ BLACK	A16	SENSOR GROUND	0*	0*	
BROWN/ YELLOW	A17	TRANSAXLE	.2-.4V	.2-.4V	
BROWN/ RED	A18	TRANSAXLE	.2-.4V	.2-.4V	

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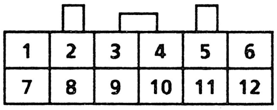
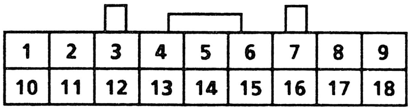
9S 7649-6E

Figure A-9 - ECM Terminal End View - Metro LSI with Conventional Ignition System Automatic Transaxle (A/T) 1.0L (VIN 6) "M" Carline



BACKVIEW ECM
CONNECTOR B



BACKVIEW ECM
CONNECTOR A

	VOLTAGE				
	KEY "ON"	ENG. RUN	CIRCUIT	PIN	WIRE COLOR
	B+	B+	MAIN RELAY	B1	WHITE/ BLUE
	6 - 7V	B+	UPSHIFT IND. LIGHT LIGHTING SW "ON"	B2	LT BLUE
	2 - 3V	B+	UPSHIFT IND. LIGHT LIGHTING SW "OFF"		
⑥	B+	B+	EGR VSV	B3	GREEN
	.9 - 1.5V	⑤	ISC	B4	RED/ WHITE
	B+	B+	INJECTOR	B5	YELLOW/ BLACK
	B+	B+	IGNITION COIL	B6	BROWN/ WHITE
	B+	B+	LONG TERM BATTERY CIRCUIT	B7	WHITE
	4 - 5	4 - 5	DIAGNOSIS SWITCH TERMINAL	B8	VIOLET/ YELLOW
	12 - 2V	B+	CHECK ENGINE LIGHT	B9	VIOLET
	B+	0*	FUEL PUMP RELAY	B10	PINK/ WHITE
	0*	0*	ECM GROUND	B11	BLACK/ BLUE
	0*	0*	IGNITION GROUND	B12	BLACK/ YELLOW

			VOLTAGE		
WIRE COLOR	PIN	CIRCUIT	KEY "ON"	ENG. RUN	
BLACK/ YELLOW	A1	CRANKING SIGNAL	0*	0*	
RED/ YELLOW	A2	ILLUMINATION LIGHT SIGNAL	0*	0*	★
LT GREEN/ YELLOW	A3	IDLE SWITCH	0*	0*	②
LT GREEN	A4	5V REFERENCE	5.0	5.0	
LT GREEN/ RED	A5	MAP SIGNAL	3 - 5	②	
WHITE	A6	O_2 SIGNAL	0*	.45 - 1	
YELLOW/ GREEN	A7	O_2 GROUND	0*	0*	
BROWN	A8	CRANK ANGLE SENSOR POSITIVE	.4 - .8	.4 - .8	
	A9	NOT USED			
BLUE/ RED	A10	A/C SIGNAL	ON * OFF B+	ON * OFF B+	
YELLOW/ GREEN	A11	VSS SIGNAL	0*	4 - 5	①
VIOLET/ GREEN	A12	TEST TERMINAL	4 - 5	4 - 5	
GREEN	A13	MAT SIGNAL	2.0	2.0	③
GREEN/ WHITE	A14	CTS SIGNAL	.45	.45	③
LT GREEN/ WHITE	A15	WOT SIGNAL	4 - 5	4 - 5	④
LT GREEN/ BLACK	A16	SENSOR GROUNDS	0*	0*	
TAN	A17	CRANK ANGLE SENSOR NEGATIVE	.4 - .8	.4 - .8	
	A18	NOT USED			

0* Less than .5 volts.
★ Will be 6 - 7 volts with light switch "ON".
① Varies as front wheels are being turned.
② Varies.
③ Varies with temperature.
④ 0 volt at wide open throttle.
⑤ Varies with load (eg: A/C)
⑥ California only

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9S 7650-6E

Figure A-10 - ECM Terminal End View - Metro with ESA Ignition System
Manual Transaxle (M/T) 1.0L (VIN 6) "M" Carline

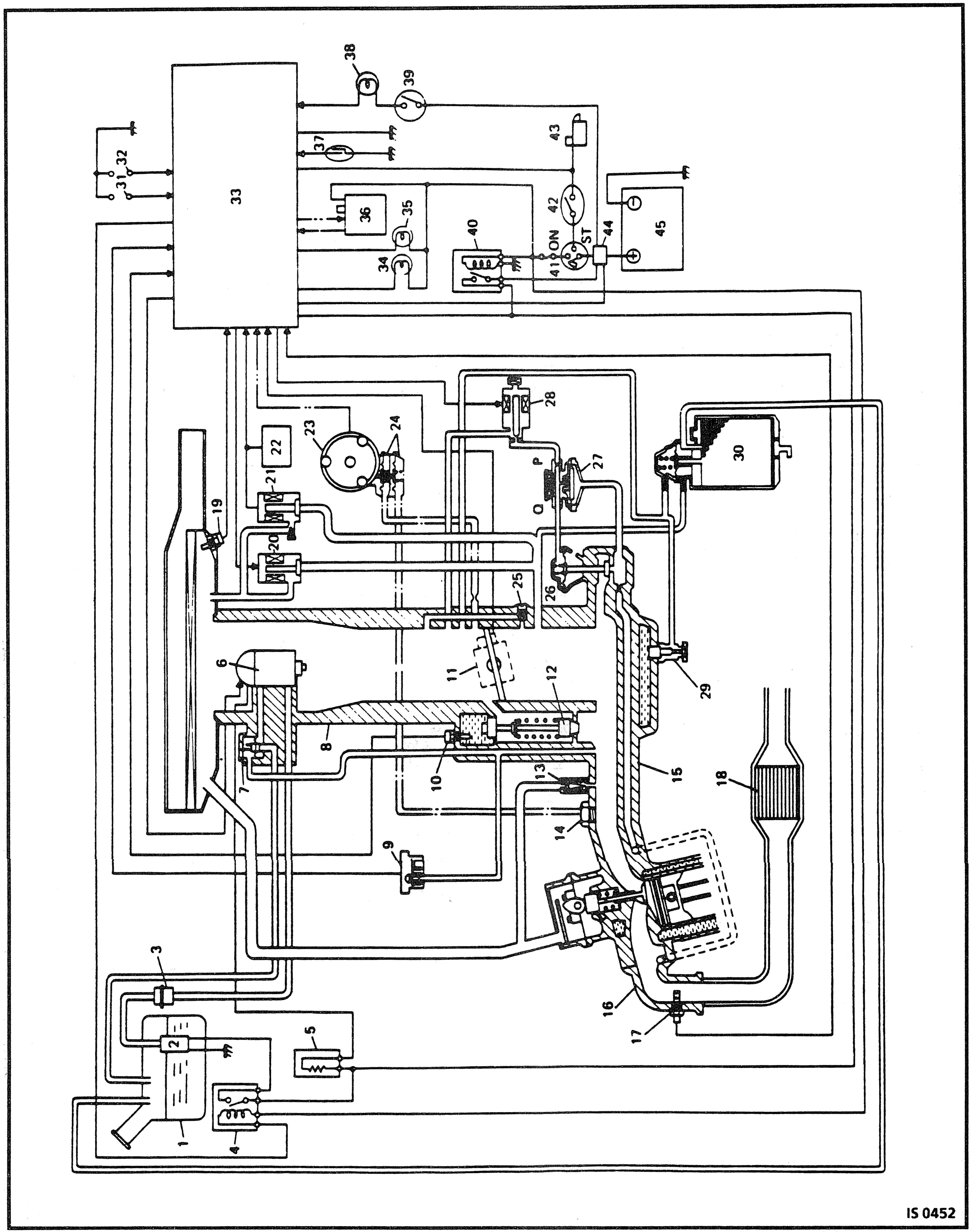
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Figure A-11 - EFI System - Metro LSI with Conventional Ignition System & Metro with ESA Ignition System Manual Transaxle (M/T) - (1 of 4) 1.0L (VIN 6) "M" Carline

PARTS IDENTIFICATION

1. Fuel Tank
2. Fuel Pump
3. Fuel Filter
4. Fuel Pump Relay
5. Fuel Injector Resistor
6. Fuel Injector
7. Fuel Pressure Regulator
8. Throttle Body
9. MAP
10. CTS
11. TS
12. Air Valve
13. PCV Valve
14. Gas Filter (Not for METRO Model)
15. Intake Manifold
16. Exhaust Manifold
17. Oxygen Sensor
18. Three-Way Catalyst
19. MAT
20. ISC Solenoid Valve
21. Air-Conditioner VSV
    (only for car with air-conditioner)
22. Air-Conditioner Amplifier
    (only for car with air-conditioner)
23. Crank Angle Sensor in Distributor
    (Metro with ESA Ignition System)
24. Vacuum Advancer LSI Model Only
25. Idle Speed Adjusting Screw
26. EGR Valve
    (Metro with ESA Ignition System)
27. EGR Modulator
    (Metro with ESA Ignition System)
28. EGR VSV
    (Metro with ESA Ignition System)

METRO LSI
CALIFORNIA
MODEL
AND
FEDERAL
MODEL

29. BVSV
30. Charcoal Canister
31. Diagnosis Switch Terminal
32. Test Switch Terminal
33. ECM
34. "Check Engine" Light
35. Shift-Up Indicator Light
36. Ignition Coil
37. Speed Sensor
38. Illumination Light
39. Lighting Switch
40. Main Relay
41. Main Switch
42. Clutch Switch
43. Starter Magnetic Switch
44. Main Fuse
45. Battery

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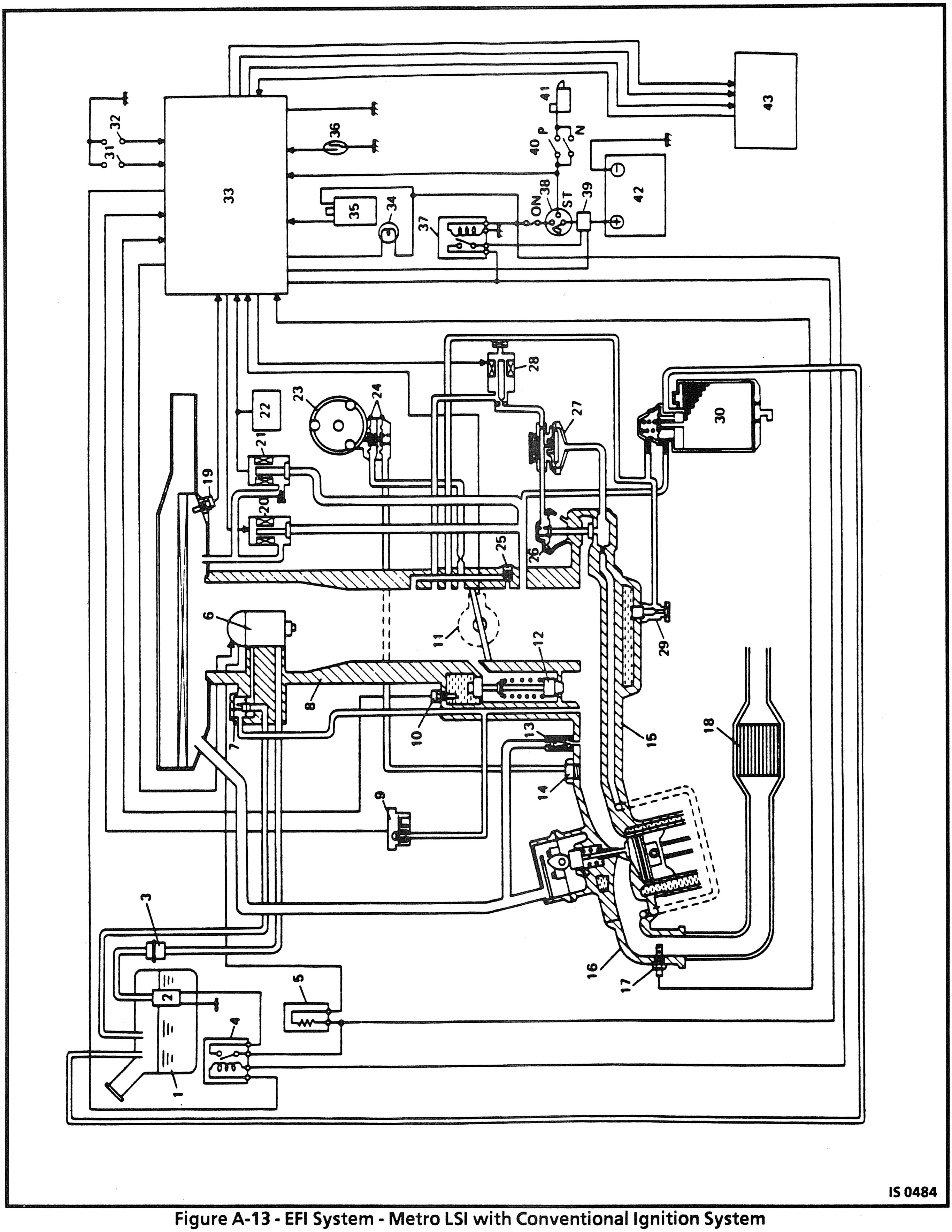
9S 7669-6E

Figure A-12 - EFI System - Metro LSI with Conventional Ignition System & Metro with ESA Ignition System
Manual Transaxle (M/T) - (2 of 4) 1.0L (VIN 6) "M" Carline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N
IS 0484

Figure A-13 - EFI System - Metro LSI with Conventional Ignition System Automatic Transaxle (A/T) - (3 of 4) 1.0L (VIN 6) "M" Carline

PARTS IDENTIFICATION

1. Fuel Tank
2. Fuel Pump
3. Fuel Filter
4. Fuel Pump Relay
5. Fuel Injector Resistor
6. Fuel Injector
7. Fuel Pressure Regulator
8. Throttle Body
9. MAP
10. CTS
11. TPS
12. Air Valve
13. PCV Valve
14. Gas Filter
15. Intake Manifold
16. Exhaust Manifold
17. Oxygen Sensor
18. Three-Way Catalyst
19. MAT
20. ISC Solenoid Valve
21. Air-Conditioner VSV
    (only for car with air-conditioner)
22. Air-Conditioner Amplifier
    (only for car with air-conditioner)
23. Distributor
24. Vacuum Advancer
25. Idle Speed Adjusting Screw
26. EGR Valve
27. EGR Modulator
28. EGR VSV

} METRO LSI CALIFORNIA ONLY

29. BVSV
30. Charcoal Canister
31. Diagnosis Switch Terminal
32. Test Switch Terminal
33. ECM
34. "Check Engine" Light
35. Ignition Coil
36. Speed Sensor
37. Main Relay
38. Main Switch
39. Main Fuse
40. Shift Switch
41. Starter Magnetic Switch
42. Battery
43. A/T Control Module

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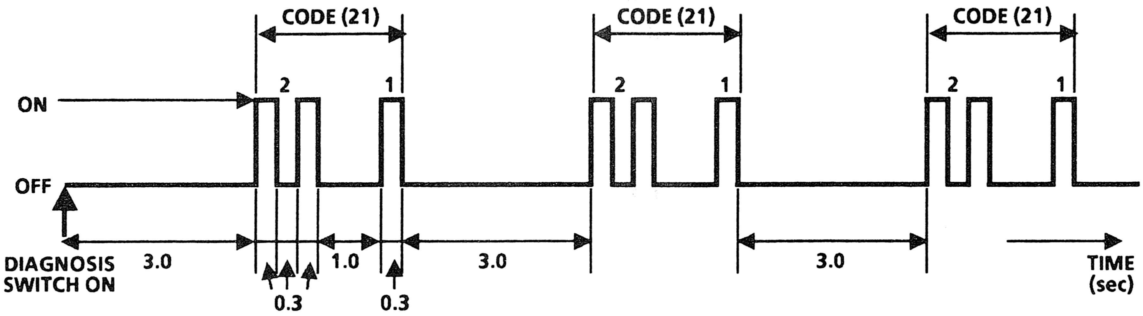
9S 7670-6E

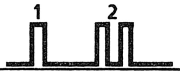
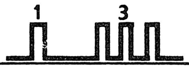
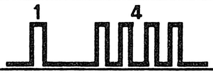
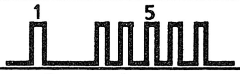
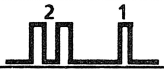
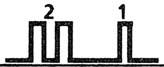
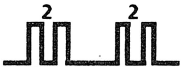
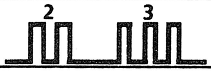
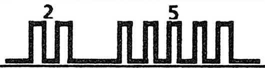
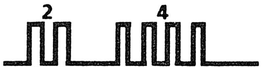
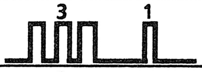
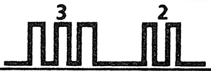
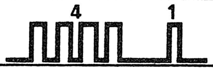
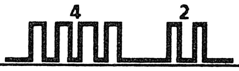
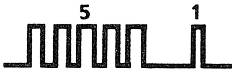
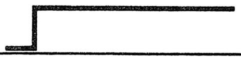
Figure A-14 - EFI System - Metro LSI with Conventional Ignition System
Automatic Transaxle (A/T) - (4 of 4) 1.0L (VIN 6) "M" Carline

DIAGNOSTIC CODE TABLE

1.0L (VIN 6) "M" CARLINE (TBI)

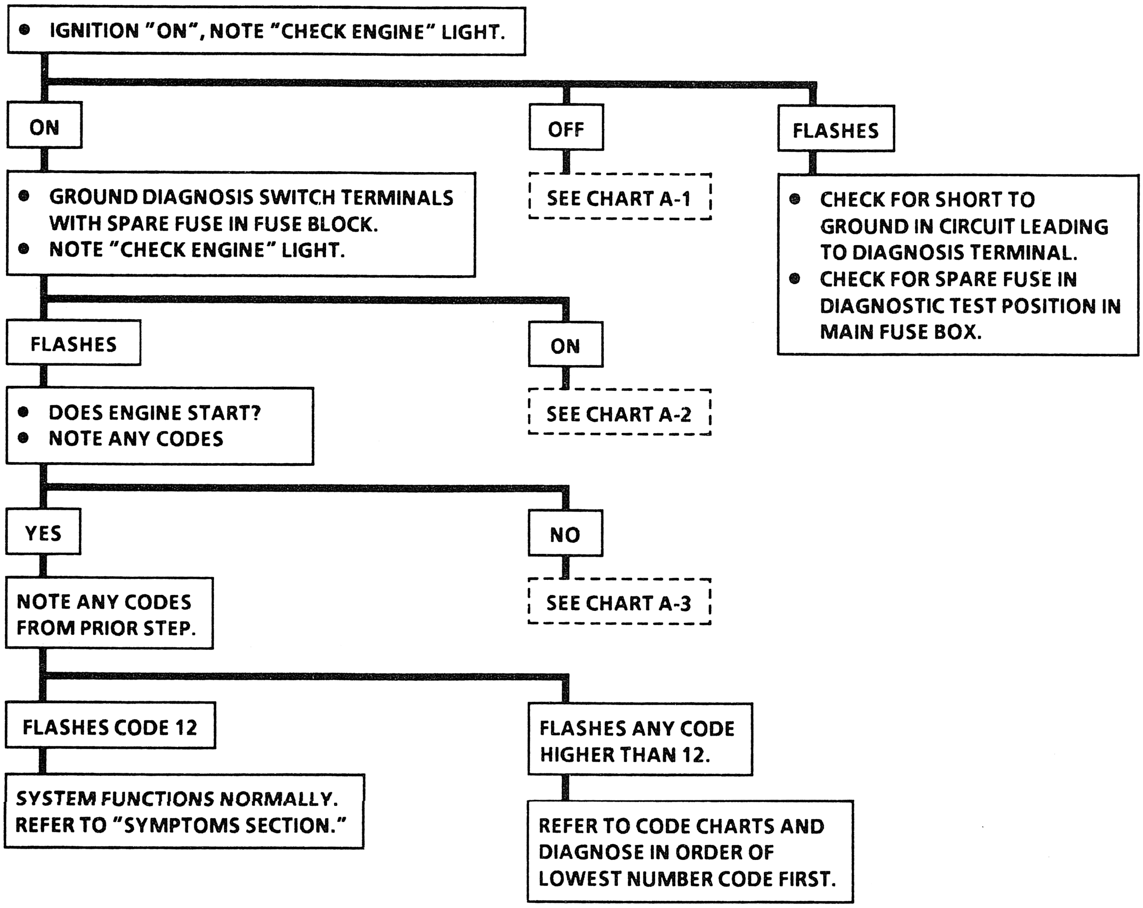
EXAMPLE: THROTTLE SWITCH (THROTTLE POSITION SENSOR FOR A/T) FAILURE (CODE: 21)


CODE (21)
CODE (21)
CODE (21)
2
1
2
1
2
1
ON
OFF
DIAGNOSIS SWITCH ON
3.0
0.3
1.0
0.3
3.0
3.0
TIME (sec)

DIAGNOSTIC CODE		DIAGNOSTIC AREA	DIAGNOSIS
NO.	MODE		
12		Normal	This code appears when none of the other codes (Below codes) is identified.
13		Oxygen sensor	Diagnose trouble according to "DIAGNOSTIC FLOW CHART" corresponding to each code No. ★ Metro with ESA Ignition
14		Coolant temperature sensor	
15			
21		Throttle switch (M/T model only)	
21		Throttle position sensor (A/T model only)	
22			
23		Manifold air temperature sensor	
25			
24		Speed sensor	
31		Manifold absolute pressure sensor	
32			
41		Ignition signal	
42		Crank angle sensor (METRO model only) ★	
51		EGR system California Only (METRO model only) ★	
ON		ECM	ECM failure 5-17-89 9S 7671-6E

DIAGNOSTIC CIRCUIT CHECK

1.0L (VIN 6) "M" CARLINE (TBI)



- IGNITION "ON", NOTE "CHECK ENGINE" LIGHT.

ON

- GROUND DIAGNOSIS SWITCH TERMINALS WITH SPARE FUSE IN FUSE BLOCK.
- NOTE "CHECK ENGINE" LIGHT.

FLASHES

- DOES ENGINE START?
- NOTE ANY CODES

YES

NOTE ANY CODES FROM PRIOR STEP.

FLASHES CODE 12

SYSTEM FUNCTIONS NORMALLY.
REFER TO "SYMPTOMS SECTION."

FLASHES ANY CODE HIGHER THAN 12.

REFER TO CODE CHARTS AND DIAGNOSE IN ORDER OF LOWEST NUMBER CODE FIRST.

NO

SEE CHART A-3

ON

SEE CHART A-2

OFF

SEE CHART A-1

FLASHES

- CHECK FOR SHORT TO GROUND IN CIRCUIT LEADING TO DIAGNOSIS TERMINAL.
- CHECK FOR SPARE FUSE IN DIAGNOSTIC TEST POSITION IN MAIN FUSE BOX.

THE DIAGNOSTIC CIRCUIT CHECK IS AN ORGANIZED APPROACH TO IDENTIFYING A PROBLEM CREATED BY AN ELECTRONIC ENGINE CONTROL SYSTEM MALFUNCTION. IT MUST BE THE STARTING POINT FOR ANY DRIVEABILITY COMPLAINT DIAGNOSIS, BECAUSE IT DIRECTS THE SERVICE TECHNICIAN TO THE NEXT LOGICAL STEP IN DIAGNOSING THE COMPLAINT.

CLEAR CODES AND CONFIRM NO "CHECK ENGINE" LIGHT.

5-15-89
9S 7672-6E

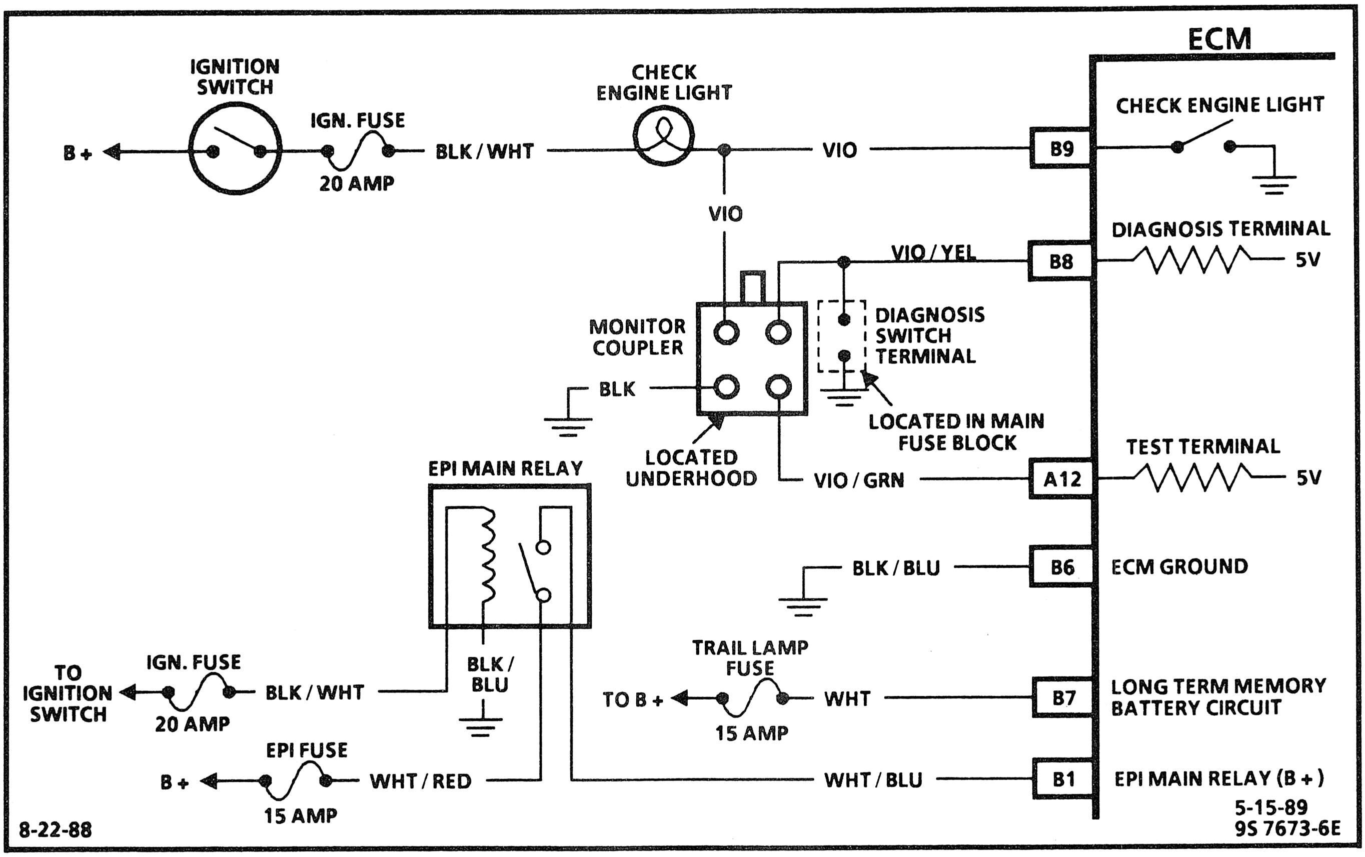

ECM
IGNITION SWITCH
B+
IGN. FUSE
20 AMP
BLK/WHT
CHECK ENGINE LIGHT
VIO
VIO
B9
CHECK ENGINE LIGHT
VIO/YEL
B8
DIAGNOSIS TERMINAL
5V
MONITOR COUPLER
DIAGNOSIS SWITCH TERMINAL
BLK
LOCATED IN MAIN FUSE BLOCK
EPI MAIN RELAY
LOCATED UNDERHOOD
VIO/GRN
A12
TEST TERMINAL
5V
BLK/BLU
B6
ECM GROUND
TO IGNITION SWITCH
IGN. FUSE
20 AMP
BLK/WHT
BLK/BLU
TRAIL LAMP FUSE
TO B+
15 AMP
WHT
B7
LONG TERM MEMORY BATTERY CIRCUIT
EPI FUSE
B+
15 AMP
WHT/RED
WHT/BLU
B1
EPI MAIN RELAY (B+)
8-22-88
5-15-89
9S 7673-6E

CHART A-1

NO "CHECK ENGINE" LIGHT
1.0L (VIN 6) "M" CARLINE (TBI)

Circuit Description:

There should always be a steady "Check Engine" light when the ignition is "ON" and engine is not running. Battery voltage is applied to the light bulb. The ECM will control the light and turn it "ON" by providing a ground path through the ECM.

Test Description: Numbers below refer to circled numbers on the diagnostic chart.

1. Providing a ground should turn the "Check Engine" light "ON".
2. Checks for B+ from control relay.
3. Verifies B+ to control relay from ignition switch.
4. Test light connected to voltage. Check the ECM for a good ground.
5. The test should be "ON" indicating the control relay is faulty.

Diagnostic Aids:

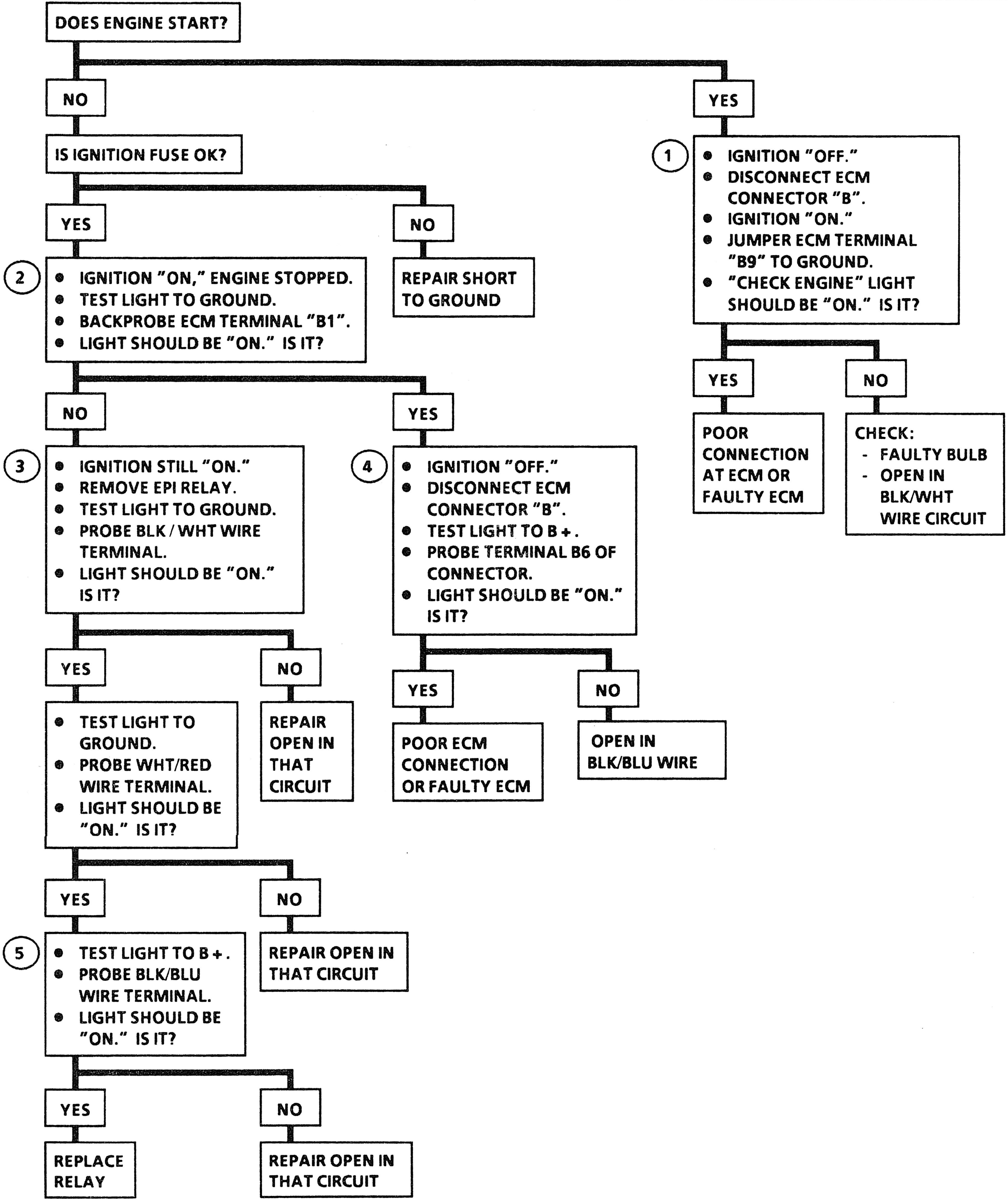
- Faulty light bulb
- Open in violet wire circuit

Engine cranks, but will not run

- Battery feed circuit open
- Control relay faulty
- Ignition circuit open
- Poor ECM connects

CHART A-1

NO "CHECK ENGINE" LIGHT
1.0L (VIN 6) "M" CARLINE (TBI)


DOES ENGINE START?
NO
IS IGNITION FUSE OK?
YES
②
• IGNITION "ON," ENGINE STOPPED.
• TEST LIGHT TO GROUND.
• BACKPROBE ECM TERMINAL "B1".
• LIGHT SHOULD BE "ON." IS IT?
NO
③
• IGNITION STILL "ON."
• REMOVE EPI RELAY.
• TEST LIGHT TO GROUND.
• PROBE BLK / WHT WIRE TERMINAL.
• LIGHT SHOULD BE "ON." IS IT?
YES
• TEST LIGHT TO GROUND.
• PROBE WHT/RED WIRE TERMINAL.
• LIGHT SHOULD BE "ON." IS IT?
YES
⑤
• TEST LIGHT TO B +.
• PROBE BLK/BLU WIRE TERMINAL.
• LIGHT SHOULD BE "ON." IS IT?
YES
REPLACE RELAY
NO
REPAIR OPEN IN THAT CIRCUIT
NO
REPAIR OPEN IN THAT CIRCUIT
NO
REPAIR OPEN IN THAT CIRCUIT
YES
④
• IGNITION "OFF."
• DISCONNECT ECM CONNECTOR "B".
• TEST LIGHT TO B +.
• PROBE TERMINAL B6 OF CONNECTOR.
• LIGHT SHOULD BE "ON." IS IT?
YES
POOR ECM CONNECTION OR FAULTY ECM
NO
OPEN IN BLK/BLU WIRE
NO
REPAIR SHORT TO GROUND
YES
①
• IGNITION "OFF."
• DISCONNECT ECM CONNECTOR "B".
• IGNITION "ON."
• JUMPER ECM TERMINAL "B9" TO GROUND.
• "CHECK ENGINE" LIGHT SHOULD BE "ON." IS IT?
YES
POOR CONNECTION AT ECM OR FAULTY ECM
NO
CHECK:
- FAULTY BULB
- OPEN IN BLK/WHT WIRE CIRCUIT

CLEAR CODES AND CONFIRM NO "CHECK ENGINE" LIGHT.

5-15-89
9S 7674-6E

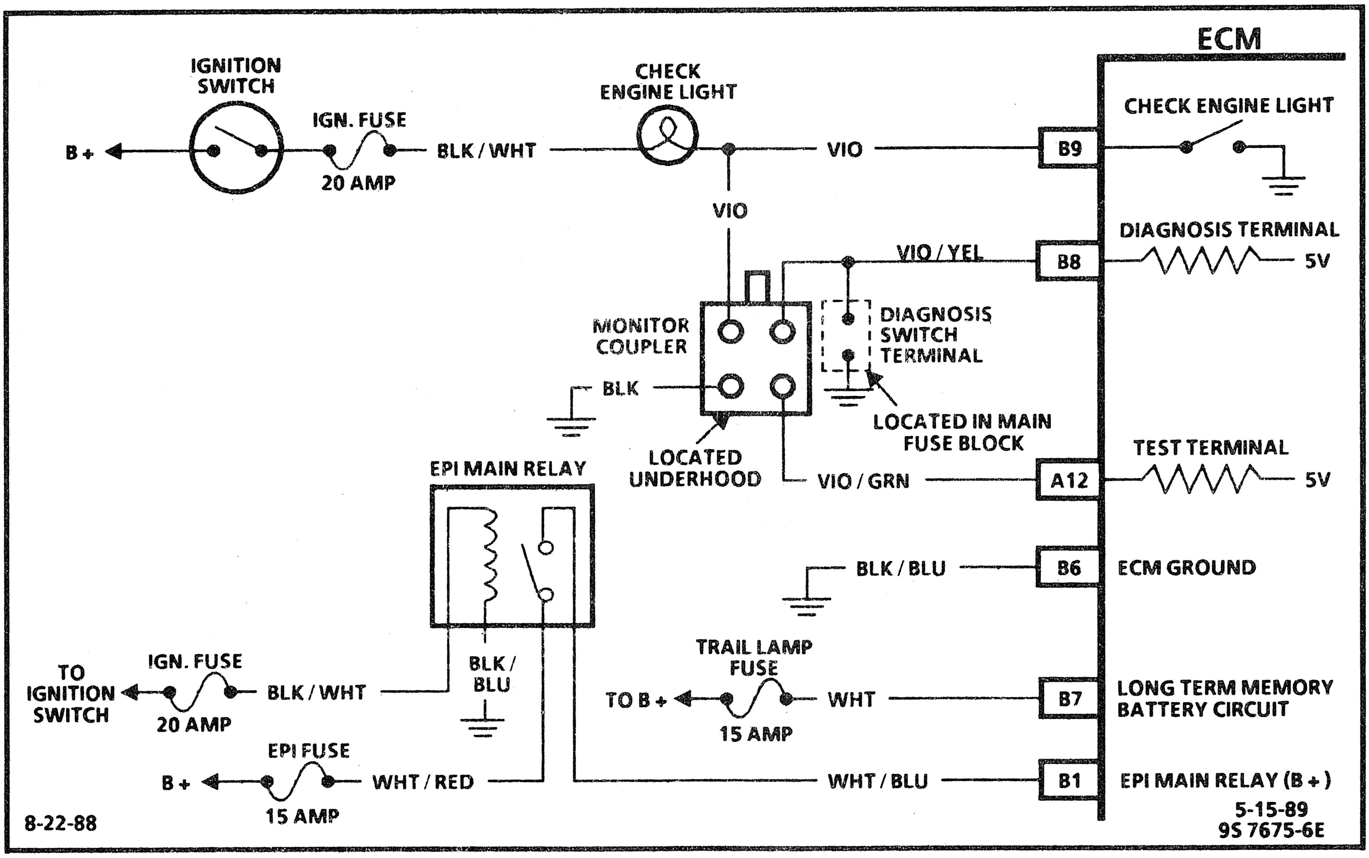

ECM
IGNITION SWITCH
B+
IGN. FUSE
20 AMP
BLK / WHT
CHECK ENGINE LIGHT
VIO
VIO
B9
CHECK ENGINE LIGHT
DIAGNOSIS TERMINAL
VIO / YEL
B8
5V
MONITOR COUPLER
DIAGNOSIS SWITCH TERMINAL
BLK
LOCATED IN MAIN FUSE BLOCK
LOCATED UNDERHOOD
EPI MAIN RELAY
TEST TERMINAL
VIO / GRN
A12
5V
BLK / BLU
B6
ECM GROUND
TO IGNITION SWITCH
IGN. FUSE
20 AMP
BLK / WHT
BLK / BLU
TRAIL LAMP FUSE
TO B+
15 AMP
WHT
B7
LONG TERM MEMORY BATTERY CIRCUIT
EPI FUSE
B+
15 AMP
WHT / RED
WHT / BLU
B1
EPI MAIN RELAY (B+)
8-22-88
5-15-89
9S 7675-6E

CHART A-2

WON'T FLASH CODE 12
"CHECK ENGINE" LIGHT "ON" STEADY
1.0L (VIN 6) "M" CARLINE (TBI)

Circuit Description:

There should always be a steady "Check Engine" light when the ignition switch is "ON". With the "Diagnosis Switch" terminal grounded the ECM will flash a Code 12, followed by any additional trouble code(s).

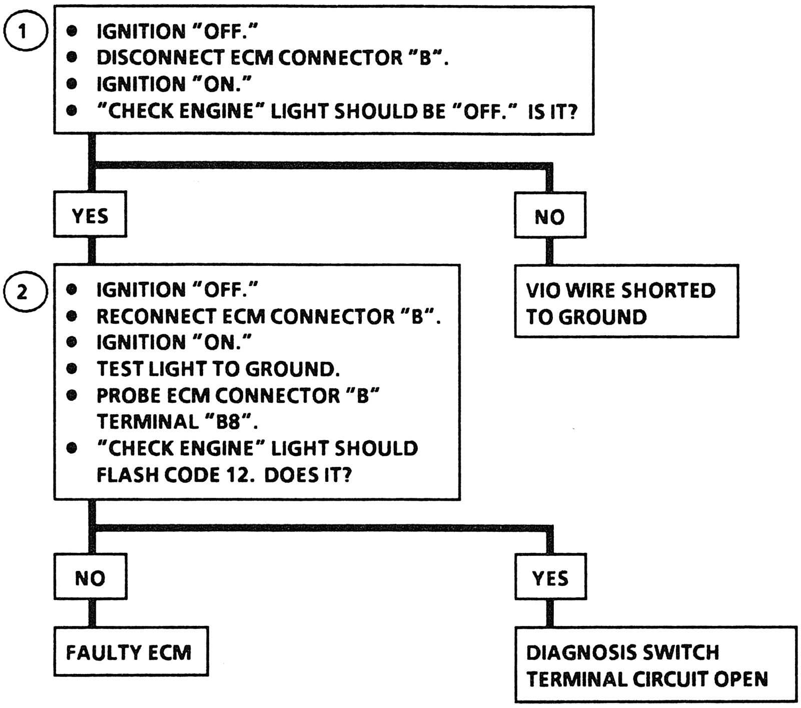
A steady "Check Engine" light suggests a short to ground or an open "Diagnosis Switch" circuit terminal.

Test Description: Numbers below refer to circled numbers on the diagnostic chart.

1. This will check for a grounded light circuit.
2. This will determine if it is an open "Diagnosis Switch" terminal circuit or a faulty ECM.

CHART A-2

WON'T FLASH CODE 12
"CHECK ENGINE" LIGHT "ON" STEADY
1.0L (VIN 6) "M" CARLINE (TBI)



①
- IGNITION "OFF."
- DISCONNECT ECM CONNECTOR "B".
- IGNITION "ON."
- "CHECK ENGINE" LIGHT SHOULD BE "OFF." IS IT?

VIO WIRE SHORTED TO GROUND

②
- IGNITION "OFF."
- RECONNECT ECM CONNECTOR "B".
- IGNITION "ON."
- TEST LIGHT TO GROUND.
- PROBE ECM CONNECTOR "B" TERMINAL "B8".
- "CHECK ENGINE" LIGHT SHOULD FLASH CODE 12. DOES IT?

FAULTY ECM

DIAGNOSIS SWITCH TERMINAL CIRCUIT OPEN

CLEAR CODES AND CONFIRM NO "CHECK ENGINE" LIGHT.

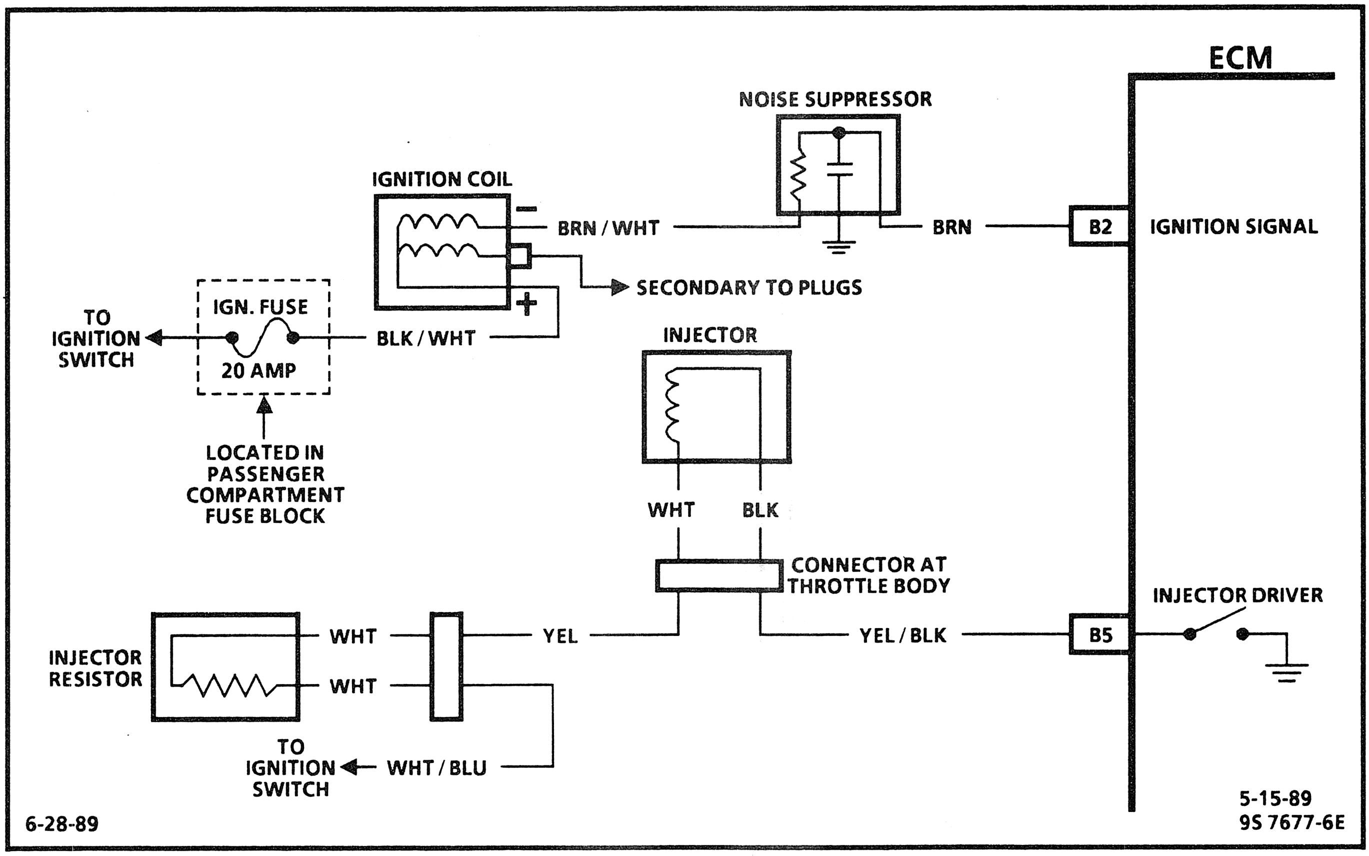

ECM
NOISE SUPPRESSOR
IGNITION COIL
BRN / WHT
BRN
B2
IGNITION SIGNAL
SECONDARY TO PLUGS
TO IGNITION SWITCH
IGN. FUSE
20 AMP
BLK / WHT
INJECTOR
LOCATED IN PASSENGER COMPARTMENT FUSE BLOCK
WHT
BLK
CONNECTOR AT THROTTLE BODY
INJECTOR DRIVER
INJECTOR RESISTOR
WHT
WHT
YEL
YEL / BLK
B5
TO IGNITION SWITCH
WHT / BLU
6-28-89
5-15-89
9S 7677-6E

CHART A-3

ENGINE CRANKS BUT WILL NOT RUN
METRO LSI CONVENTIONAL IGNITION SYSTEM (WITH VACUUM ADVANCE)
1.0L (VIN 6) "M" CARLINE (TBI)

Circuit Description:

The ignition coil is controlled by the pick-up coil inside the distributor. The pick-up coil pulls the voltage low to one side of the coil causing the secondary coil winding to produce voltage to the fire spark plugs. The ECM receives a tach signal to pulse the injector at the same time the spark plugs fired.

Test Description: Numbers below refer to circled numbers on the diagnostic chart.

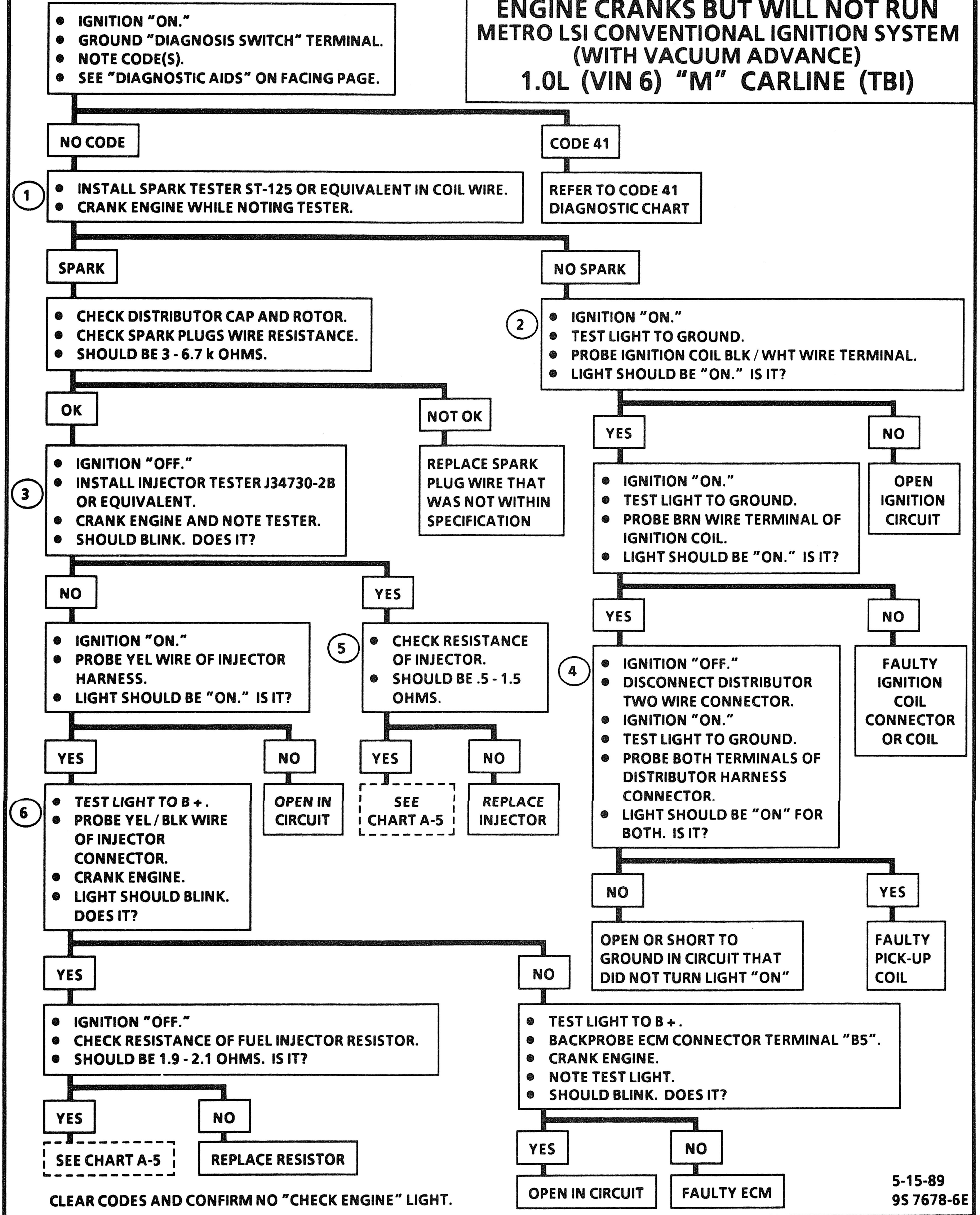
1. Checking for spark to spark plugs.
2. Coil should have B+ to both terminals.
3. The injector test light should blink when cranking.
4. Should have B+ on both wires to distributor.
5. No resistance or high resistance would cause a crank but will not run.
6. Test light should blink while cranking the engine.

Diagnostic Aids:

- Water or foreign material can cause a no start during freezing weather. The engine may start after 5 or 6 minutes in a heated shop. The problem may nut re-occur until an overnight park in freezing temperatures.
- Be sure to check connectors for contamination, corrosion or bent terminals.

CHART A-3

ENGINE CRANKS BUT WILL NOT RUN
METRO LSI CONVENTIONAL IGNITION SYSTEM
(WITH VACUUM ADVANCE)
1.0L (VIN 6) "M" CARLINE (TBI)


• IGNITION "ON."
• GROUND "DIAGNOSIS SWITCH" TERMINAL.
• NOTE CODE(S).
• SEE "DIAGNOSTIC AIDS" ON FACING PAGE.
NO CODE
CODE 41
REFER TO CODE 41 DIAGNOSTIC CHART
①
• INSTALL SPARK TESTER ST-125 OR EQUIVALENT IN COIL WIRE.
• CRANK ENGINE WHILE NOTING TESTER.
SPARK
• CHECK DISTRIBUTOR CAP AND ROTOR.
• CHECK SPARK PLUGS WIRE RESISTANCE.
• SHOULD BE 3 - 6.7 k OHMS.
OK
NOT OK
REPLACE SPARK PLUG WIRE THAT WAS NOT WITHIN SPECIFICATION
③
• IGNITION "OFF."
• INSTALL INJECTOR TESTER J34730-2B OR EQUIVALENT.
• CRANK ENGINE AND NOTE TESTER.
• SHOULD BLINK. DOES IT?
NO
• IGNITION "ON."
• PROBE YEL WIRE OF INJECTOR HARNESS.
• LIGHT SHOULD BE "ON." IS IT?
YES
⑥
• TEST LIGHT TO B+.
• PROBE YEL / BLK WIRE OF INJECTOR CONNECTOR.
• CRANK ENGINE.
• LIGHT SHOULD BLINK. DOES IT?
YES
• IGNITION "OFF."
• CHECK RESISTANCE OF FUEL INJECTOR RESISTOR.
• SHOULD BE 1.9 - 2.1 OHMS. IS IT?
YES
SEE CHART A-5
NO
REPLACE RESISTOR
NO
• TEST LIGHT TO B+.
• BACKPROBE ECM CONNECTOR TERMINAL "B5".
• CRANK ENGINE.
• NOTE TEST LIGHT.
• SHOULD BLINK. DOES IT?
YES
OPEN IN CIRCUIT
NO
FAULTY ECM
NO
OPEN IN CIRCUIT
YES
⑤
• CHECK RESISTANCE OF INJECTOR.
• SHOULD BE .5 - 1.5 OHMS.
YES
SEE CHART A-5
NO
REPLACE INJECTOR
NO SPARK
②
• IGNITION "ON."
• TEST LIGHT TO GROUND.
• PROBE IGNITION COIL BLK / WHT WIRE TERMINAL.
• LIGHT SHOULD BE "ON." IS IT?
YES
• IGNITION "ON."
• TEST LIGHT TO GROUND.
• PROBE BRN WIRE TERMINAL OF IGNITION COIL.
• LIGHT SHOULD BE "ON." IS IT?
YES
④
• IGNITION "OFF."
• DISCONNECT DISTRIBUTOR TWO WIRE CONNECTOR.
• IGNITION "ON."
• TEST LIGHT TO GROUND.
• PROBE BOTH TERMINALS OF DISTRIBUTOR HARNESS CONNECTOR.
• LIGHT SHOULD BE "ON" FOR BOTH. IS IT?
NO
OPEN OR SHORT TO GROUND IN CIRCUIT THAT DID NOT TURN LIGHT "ON"
YES
FAULTY PICK-UP COIL
NO
FAULTY IGNITION COIL CONNECTOR OR COIL
NO
OPEN IGNITION CIRCUIT

CLEAR CODES AND CONFIRM NO "CHECK ENGINE" LIGHT.

5-15-89
9S 7678-6E

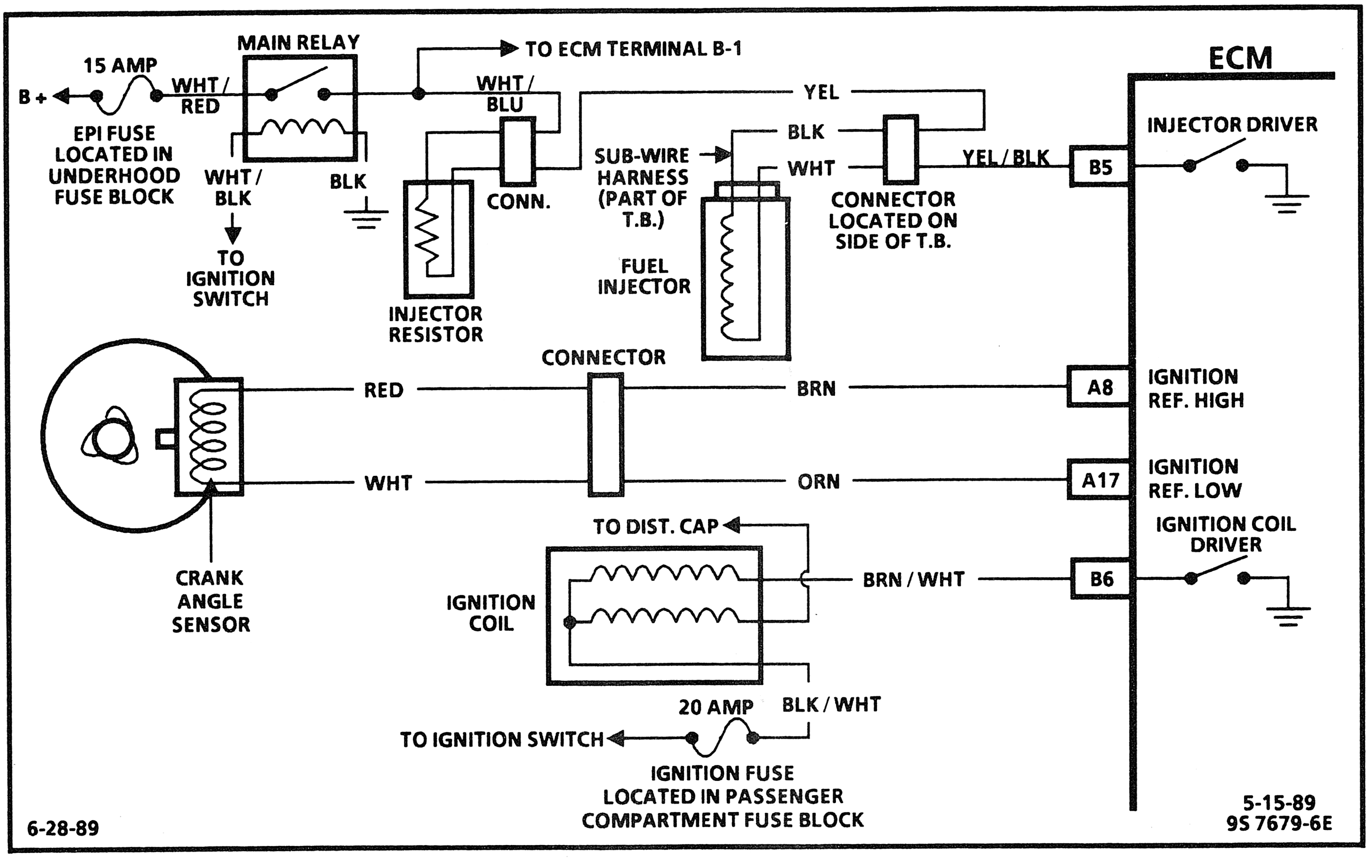

MAIN RELAY
15 AMP
B+
WHT/RED
EPI FUSE LOCATED IN UNDERHOOD FUSE BLOCK
WHT/BLK
BLK
TO IGNITION SWITCH
TO ECM TERMINAL B-1
WHT/BLU
CONN.
INJECTOR RESISTOR
YEL
BLK
WHT
SUB-WIRE HARNESS (PART OF T.B.)
FUEL INJECTOR
CONNECTOR LOCATED ON SIDE OF T.B.
YEL/BLK
ECM
INJECTOR DRIVER
B5
CONNECTOR
RED
BRN
A8
IGNITION REF. HIGH
WHT
ORN
A17
IGNITION REF. LOW
CRANK ANGLE SENSOR
TO DIST. CAP
IGNITION COIL DRIVER
BRN/WHT
B6
IGNITION COIL
20 AMP
BLK/WHT
TO IGNITION SWITCH
IGNITION FUSE LOCATED IN PASSENGER COMPARTMENT FUSE BLOCK
6-28-89
5-15-89
9S 7679-6E

CHART A-3

ENGINE CRANKS BUT WILL NOT RUN
METRO WITH ESA IGNITION SYSTEM (WITHOUT VACUUM ADVANCE)
1.0L (VIN 6) "M" CARLINE (TBI)

Circuit Description:

The ECM supplies voltage to a module inside the distributor. The module supplies this voltage to the crank angle sensor, the sensor toggles this voltage to ground.

Test Description: Numbers below refer to circled numbers on the diagnostic chart.

1. Open in either fuse could be the cause of a 'Crank But Will Not Run'.
2. This will check the spark plug wire for opens.
3. This test inspects the injector.
4. This will determine if the ignition coil is supplying spark to distributor.
5. This tests the ECM toggling of the ignition coil.

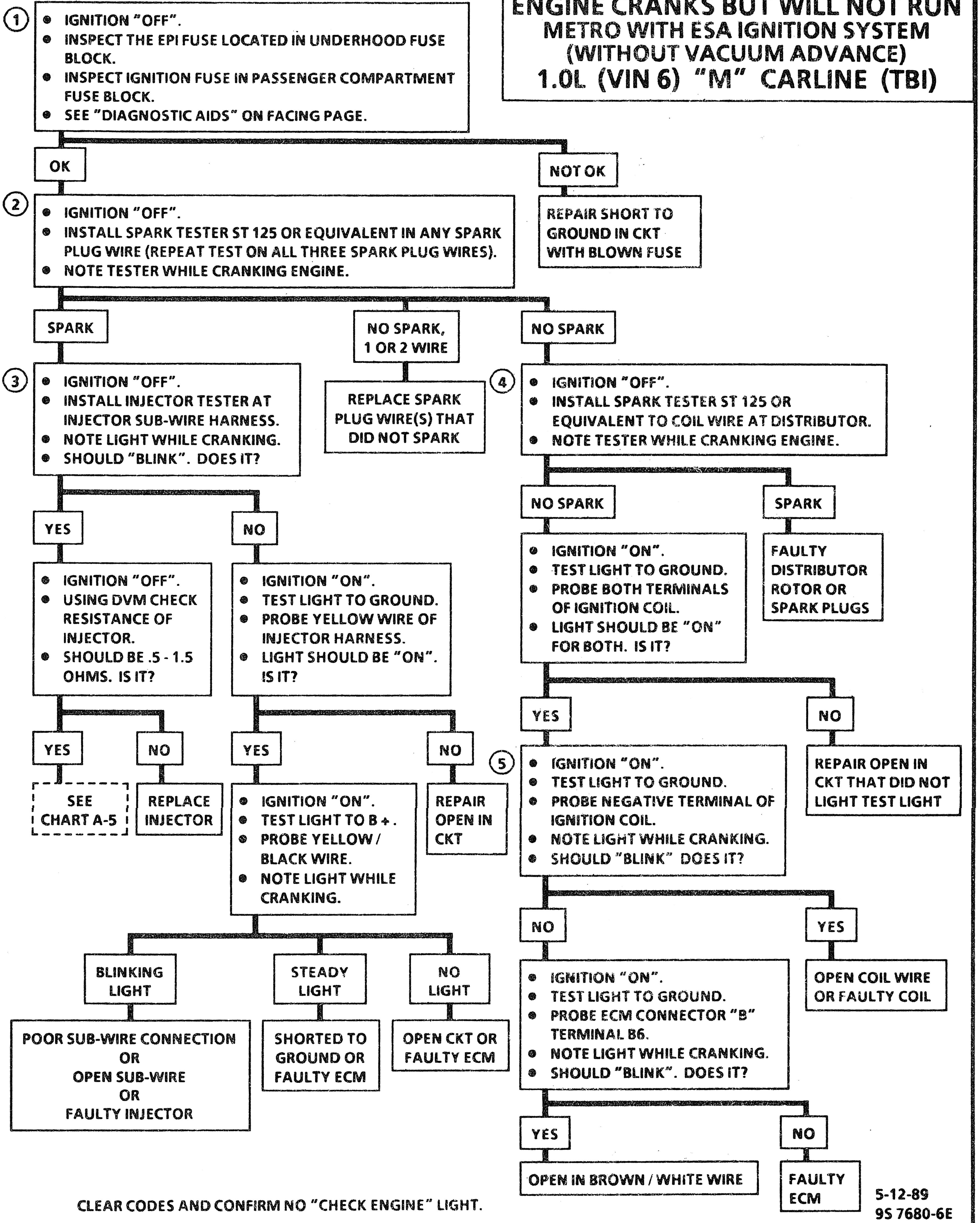
Diagnostic Aids:

- Water or foreign material can cause a no start during freezing weather. The engine may start after 5 or 6 minutes in a heated shop. The problem may not re-occur until an overnight park in freezing temperatures.
- Be sure to check connectors for contamination, corrosion or bent terminals.

CHART A-3

ENGINE CRANKS BUT WILL NOT RUN
METRO WITH ESA IGNITION SYSTEM (WITHOUT VACUUM ADVANCE)
1.0L (VIN 6) "M" CARLINE (TBI)

NOTE: BEFORE USING THIS CHART VERIFY FUEL QUANTITY. MAKE A CAREFUL VISUAL INSPECTION OF DISTRIBUTOR FOR BROKEN SHAFT OR DAMAGE TO CAP AND / OR ROTOR.


①
• IGNITION "OFF".
• INSPECT THE EPI FUSE LOCATED IN UNDERHOOD FUSE BLOCK.
• INSPECT IGNITION FUSE IN PASSENGER COMPARTMENT FUSE BLOCK.
• SEE "DIAGNOSTIC AIDS" ON FACING PAGE.
OK
NOT OK
REPAIR SHORT TO GROUND IN CKT WITH BLOWN FUSE
②
• IGNITION "OFF".
• INSTALL SPARK TESTER ST 125 OR EQUIVALENT IN ANY SPARK PLUG WIRE (REPEAT TEST ON ALL THREE SPARK PLUG WIRES).
• NOTE TESTER WHILE CRANKING ENGINE.
SPARK
NO SPARK, 1 OR 2 WIRE
NO SPARK
REPLACE SPARK PLUG WIRE(S) THAT DID NOT SPARK
③
• IGNITION "OFF".
• INSTALL INJECTOR TESTER AT INJECTOR SUB-WIRE HARNESS.
• NOTE LIGHT WHILE CRANKING.
• SHOULD "BLINK". DOES IT?
④
• IGNITION "OFF".
• INSTALL SPARK TESTER ST 125 OR EQUIVALENT TO COIL WIRE AT DISTRIBUTOR.
• NOTE TESTER WHILE CRANKING ENGINE.
YES
NO
NO SPARK
SPARK
• IGNITION "OFF".
• USING DVM CHECK RESISTANCE OF INJECTOR.
• SHOULD BE .5 - 1.5 OHMS. IS IT?
• IGNITION "ON".
• TEST LIGHT TO GROUND.
• PROBE YELLOW WIRE OF INJECTOR HARNESS.
• LIGHT SHOULD BE "ON". IS IT?
• IGNITION "ON".
• TEST LIGHT TO GROUND.
• PROBE BOTH TERMINALS OF IGNITION COIL.
• LIGHT SHOULD BE "ON" FOR BOTH. IS IT?
FAULTY DISTRIBUTOR ROTOR OR SPARK PLUGS
YES
NO
YES
NO
YES
NO
SEE CHART A-5
REPLACE INJECTOR
• IGNITION "ON".
• TEST LIGHT TO B+.
• PROBE YELLOW / BLACK WIRE.
• NOTE LIGHT WHILE CRANKING.
REPAIR OPEN IN CKT
⑤
• IGNITION "ON".
• TEST LIGHT TO GROUND.
• PROBE NEGATIVE TERMINAL OF IGNITION COIL.
• NOTE LIGHT WHILE CRANKING.
• SHOULD "BLINK" DOES IT?
REPAIR OPEN IN CKT THAT DID NOT LIGHT TEST LIGHT
NO
YES
OPEN COIL WIRE OR FAULTY COIL
BLINKING LIGHT
STEADY LIGHT
NO LIGHT
POOR SUB-WIRE CONNECTION OR OPEN SUB-WIRE OR FAULTY INJECTOR
SHORTED TO GROUND OR FAULTY ECM
OPEN CKT OR FAULTY ECM
• IGNITION "ON".
• TEST LIGHT TO GROUND.
• PROBE ECM CONNECTOR "B" TERMINAL B6.
• NOTE LIGHT WHILE CRANKING.
• SHOULD "BLINK". DOES IT?
YES
NO
OPEN IN BROWN / WHITE WIRE
FAULTY ECM

CLEAR CODES AND CONFIRM NO "CHECK ENGINE" LIGHT.

5-12-89
9S 7680-6E

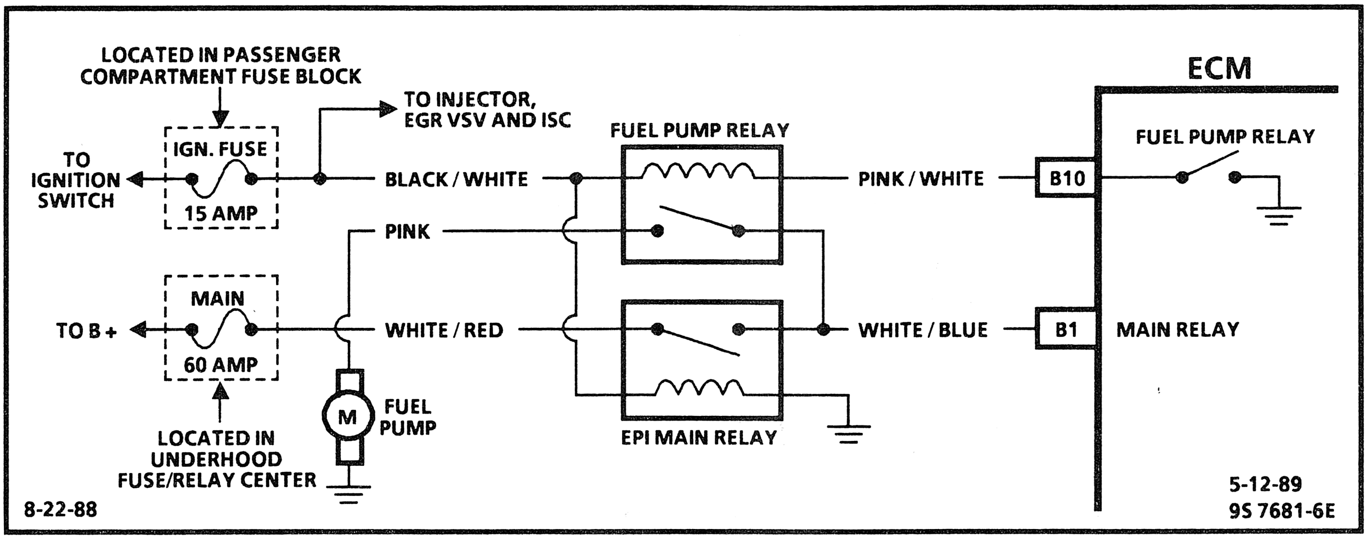

LOCATED IN PASSENGER COMPARTMENT FUSE BLOCK
TO INJECTOR, EGR VSV AND ISC
TO IGNITION SWITCH
IGN. FUSE
15 AMP
BLACK / WHITE
PINK
FUEL PUMP RELAY
PINK / WHITE
ECM
B10
FUEL PUMP RELAY
MAIN
TO B+
60 AMP
WHITE / RED
WHITE / BLUE
B1
MAIN RELAY
M
FUEL PUMP
LOCATED IN UNDERHOOD FUSE/RELAY CENTER
EPI MAIN RELAY
8-22-88
5-12-89
9S 7681-6E

CHART A-5

ENGINE CRANKS BUT WILL NOT RUN

(FUEL SYSTEM ELECTRICAL TEST)

1.0L (VIN 6) "M" CARLINE (TBI)

Circuit Description:

When the ignition switch is turned "ON" the ECM will turn "ON" the fuel pump relay to operate the fuel pump for 2 seconds. If the ECM receives ignition reference pulses the fuel pump will continue to run. If the ECM receives no reference pulses from the ignition circuit it will shut "OFF" the fuel pump.

Test Description: Numbers below refer to circled numbers on the diagnostic chart.

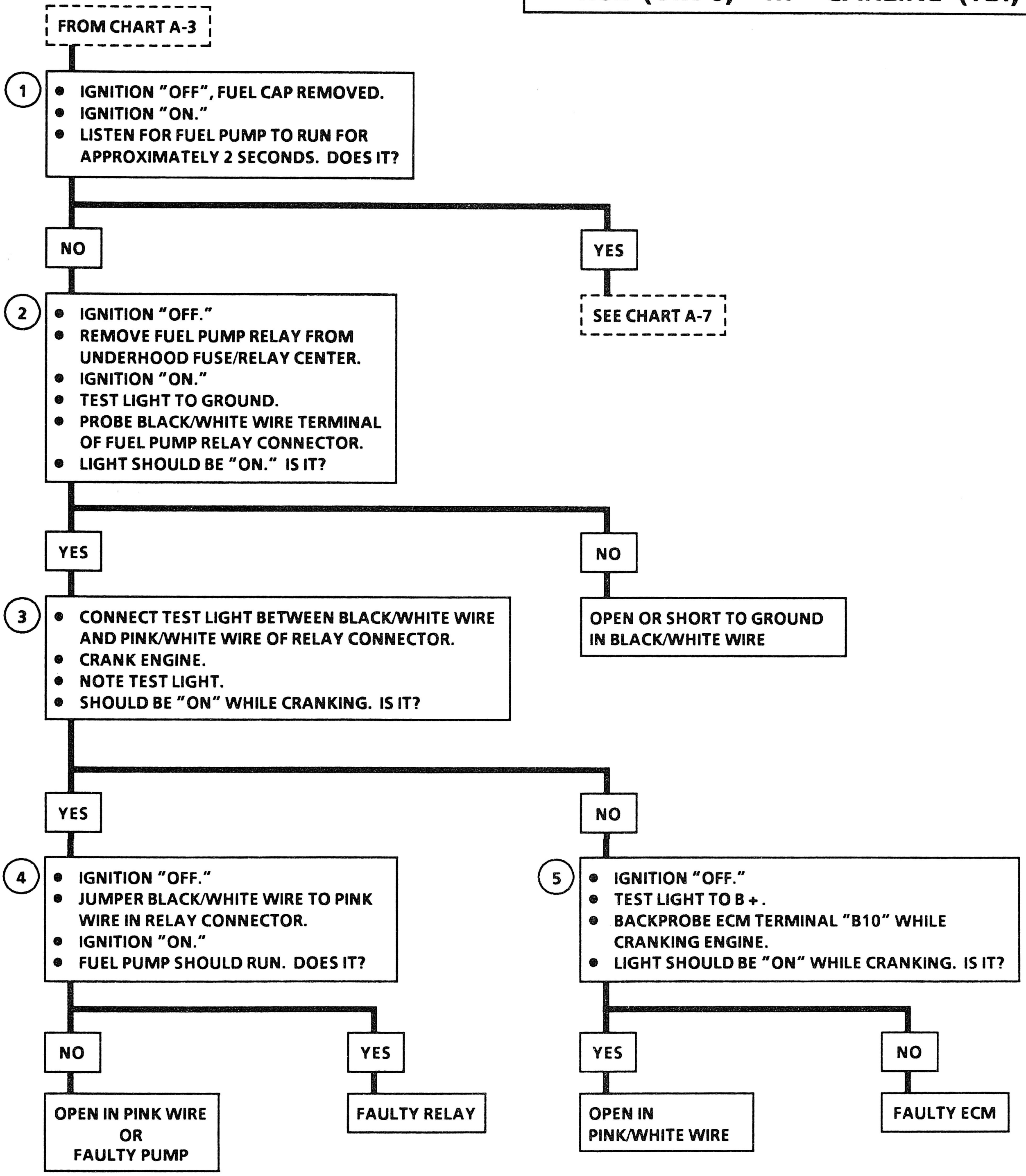
1. Fuel pump should run for approximately 2 seconds when ignition is "ON".
2. Test for an open between fuse and relay.
3. Check for open or the ECM fuel pump driver being faulty.
4. Jumpering relay connect to fuel pump. Power lead will test the fuel pump and the lead wire.
5. This will determine if ECM fuel pump driver circuit inside ECM is faulty.

Diagnostic Aids:

Visual inspection of wiring and connectors should be made if an intermittent problem exists.

CHART A-5

ENGINE CRANKS BUT WILL NOT RUN
(FUEL SYSTEM ELECTRICAL TEST)
1.0L (VIN 6) "M" CARLINE (TBI)



①
- IGNITION "OFF", FUEL CAP REMOVED.
- IGNITION "ON."
- LISTEN FOR FUEL PUMP TO RUN FOR APPROXIMATELY 2 SECONDS. DOES IT?

②
- IGNITION "OFF."
- REMOVE FUEL PUMP RELAY FROM UNDERHOOD FUSE/RELAY CENTER.
- IGNITION "ON."
- TEST LIGHT TO GROUND.
- PROBE BLACK/WHITE WIRE TERMINAL OF FUEL PUMP RELAY CONNECTOR.
- LIGHT SHOULD BE "ON." IS IT?

③
- CONNECT TEST LIGHT BETWEEN BLACK/WHITE WIRE AND PINK/WHITE WIRE OF RELAY CONNECTOR.
- CRANK ENGINE.
- NOTE TEST LIGHT.
- SHOULD BE "ON" WHILE CRANKING. IS IT?

OPEN OR SHORT TO GROUND IN BLACK/WHITE WIRE

④
- IGNITION "OFF."
- JUMPER BLACK/WHITE WIRE TO PINK WIRE IN RELAY CONNECTOR.
- IGNITION "ON."
- FUEL PUMP SHOULD RUN. DOES IT?

⑤
- IGNITION "OFF."
- TEST LIGHT TO B+.
- BACKPROBE ECM TERMINAL "B10" WHILE CRANKING ENGINE.
- LIGHT SHOULD BE "ON" WHILE CRANKING. IS IT?

OPEN IN PINK WIRE OR FAULTY PUMP

FAULTY RELAY

OPEN IN PINK/WHITE WIRE

FAULTY ECM

5-12-89

CLEAR CODES AND CONFIRM NO "CHECK ENGINE" LIGHT.

9S 7682-6E

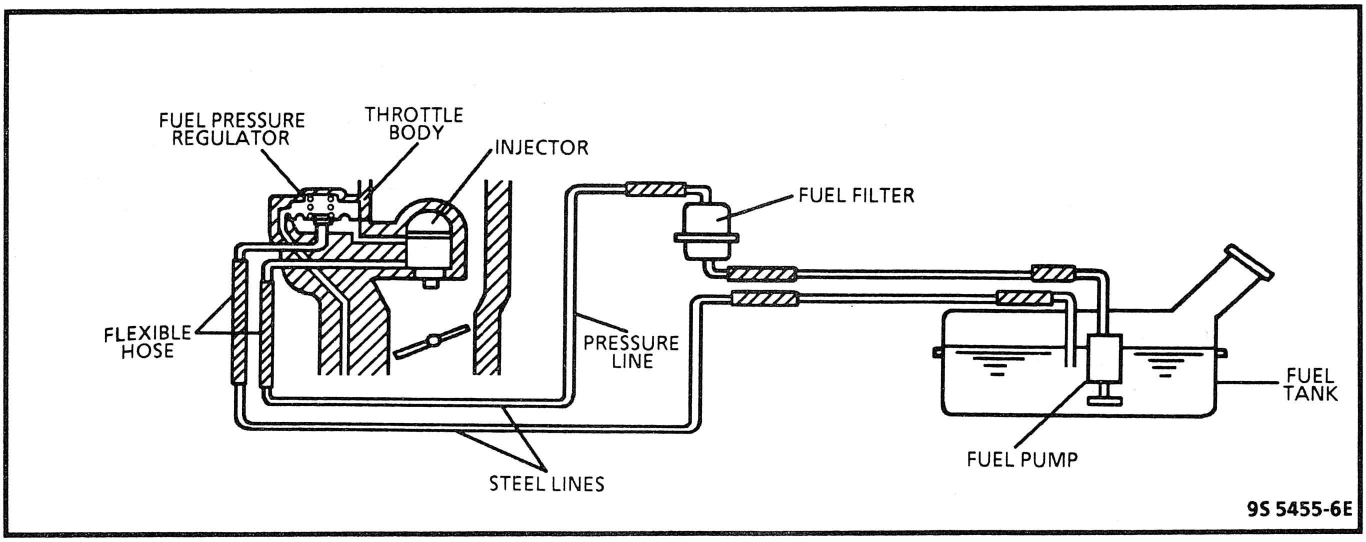


CHART A-7

(Page 1 of 3)

FUEL SYSTEM PRESSURE TEST 1.0L (VIN 6) "M" CARLINE (TBI)

Circuit Description:

When the ignition switch is turned "ON", the Electronic Control Module (ECM) will turn "ON" the in-tank fuel pump. It will remain "ON" as long as the engine is cranking or running, and the ECM is receiving reference pulses. If there are no reference pulses, the ECM will shut "OFF" the fuel pump in about 2 seconds after ignition "ON" or engine stops.

The pump will deliver fuel to the fuel rail and injectors, then to the pressure regulator, where the system pressure is controlled to about 160-210 kPa (23.2-30.5 psi) depending on engine operating conditions. Excess fuel is then returned to the fuel tank.

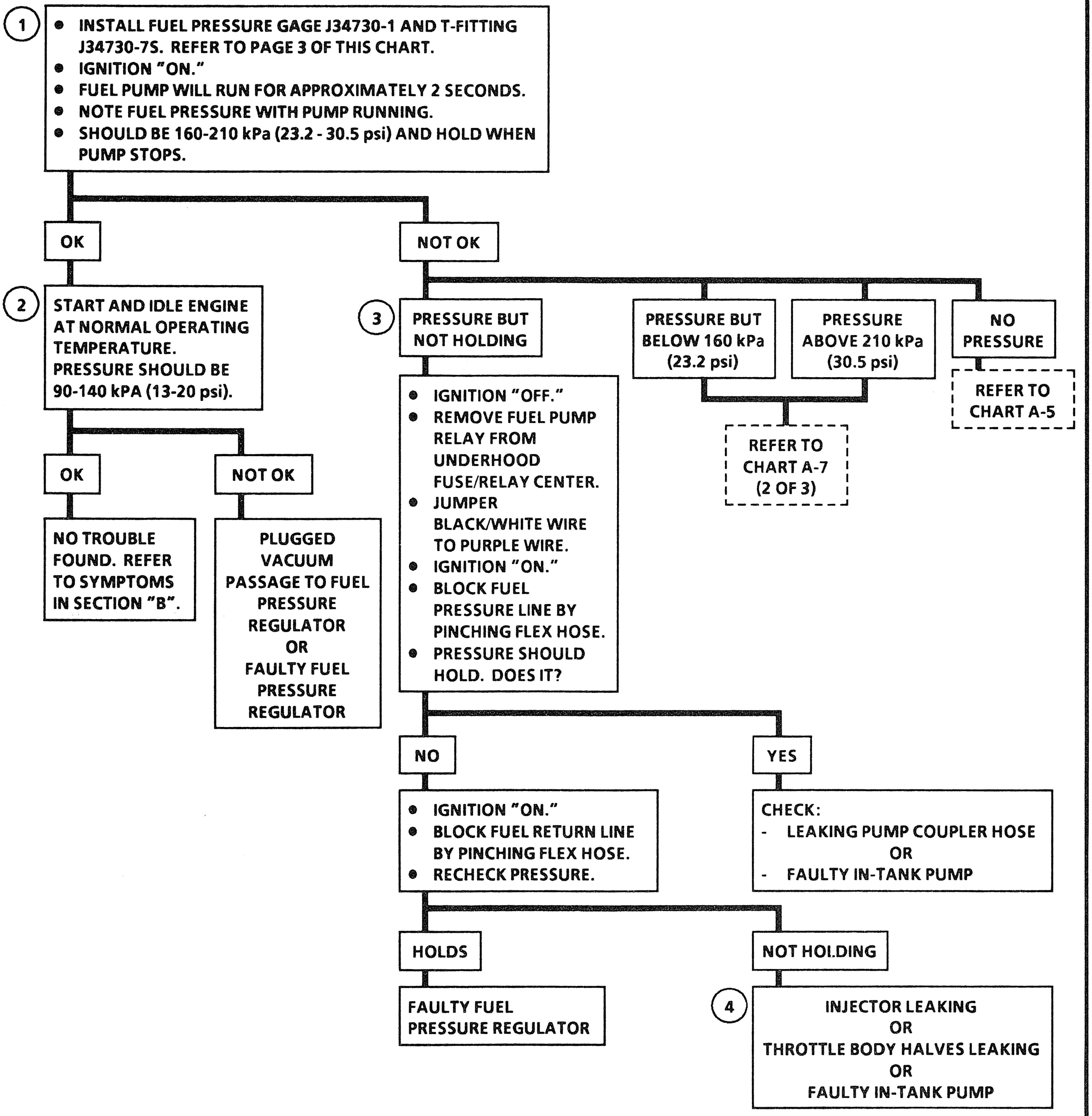
Test Description: Numbers below refer to circled numbers on the diagnostic chart.

1. Wrap a shop towel around the fuel pressure connector to absorb any small amount of fuel leakage that may occur when installing the gage. Ignition "ON" pump pressure should be 160-210 kPa (23.2-30.5 psi). This pressure is controlled by spring pressure within the regulator assembly.
2. When the engine is idling, the manifold pressure is low (high vacuum) and is applied to the fuel regulator diaphragm. This will offset the spring and result in a lower fuel pressure. This idle pressure will vary somewhat depending on barometric pressure, however, the pressure idling should be less indicating pressure regulator control.
3. Pressure that continues to fall quickly is caused by one of the following:
   - In-tank fuel pump check valve not holding.
   - Pump coupling hose.
   - Fuel pressure regulator valve leaking.
   - Injector(s) sticking open.
4. An injector sticking open can best be determined by checking for a fouled or saturated spark plug(s).
   - Pressurize the fuel system and observe for injector leaking.

CHART A-7

(Page 1 of 3)

FUEL SYSTEM PRESSURE TEST
1.0L (VIN 6) "M" CARLINE (TBI)


1
• INSTALL FUEL PRESSURE GAGE J34730-1 AND T-FITTING J34730-7S. REFER TO PAGE 3 OF THIS CHART.
• IGNITION "ON."
• FUEL PUMP WILL RUN FOR APPROXIMATELY 2 SECONDS.
• NOTE FUEL PRESSURE WITH PUMP RUNNING.
• SHOULD BE 160-210 kPa (23.2 - 30.5 psi) AND HOLD WHEN PUMP STOPS.
OK
NOT OK
2
START AND IDLE ENGINE AT NORMAL OPERATING TEMPERATURE. PRESSURE SHOULD BE 90-140 kPA (13-20 psi).
OK
NOT OK
NO TROUBLE FOUND. REFER TO SYMPTOMS IN SECTION "B".
PLUGGED VACUUM PASSAGE TO FUEL PRESSURE REGULATOR OR FAULTY FUEL PRESSURE REGULATOR
3
PRESSURE BUT NOT HOLDING
PRESSURE BUT BELOW 160 kPa (23.2 psi)
PRESSURE ABOVE 210 kPa (30.5 psi)
NO PRESSURE
REFER TO CHART A-5
REFER TO CHART A-7 (2 OF 3)
• IGNITION "OFF."
• REMOVE FUEL PUMP RELAY FROM UNDERHOOD FUSE/RELAY CENTER.
• JUMPER BLACK/WHITE WIRE TO PURPLE WIRE.
• IGNITION "ON."
• BLOCK FUEL PRESSURE LINE BY PINCHING FLEX HOSE.
• PRESSURE SHOULD HOLD. DOES IT?
NO
YES
• IGNITION "ON."
• BLOCK FUEL RETURN LINE BY PINCHING FLEX HOSE.
• RECHECK PRESSURE.
CHECK:
- LEAKING PUMP COUPLER HOSE
OR
- FAULTY IN-TANK PUMP
HOLDS
NOT HOLDING
FAULTY FUEL PRESSURE REGULATOR
4
INJECTOR LEAKING OR THROTTLE BODY HALVES LEAKING OR FAULTY IN-TANK PUMP

CLEAR CODES AND CONFIRM NO "CHECK ENGINE" LIGHT.

7-6-89
9S 7683-6E

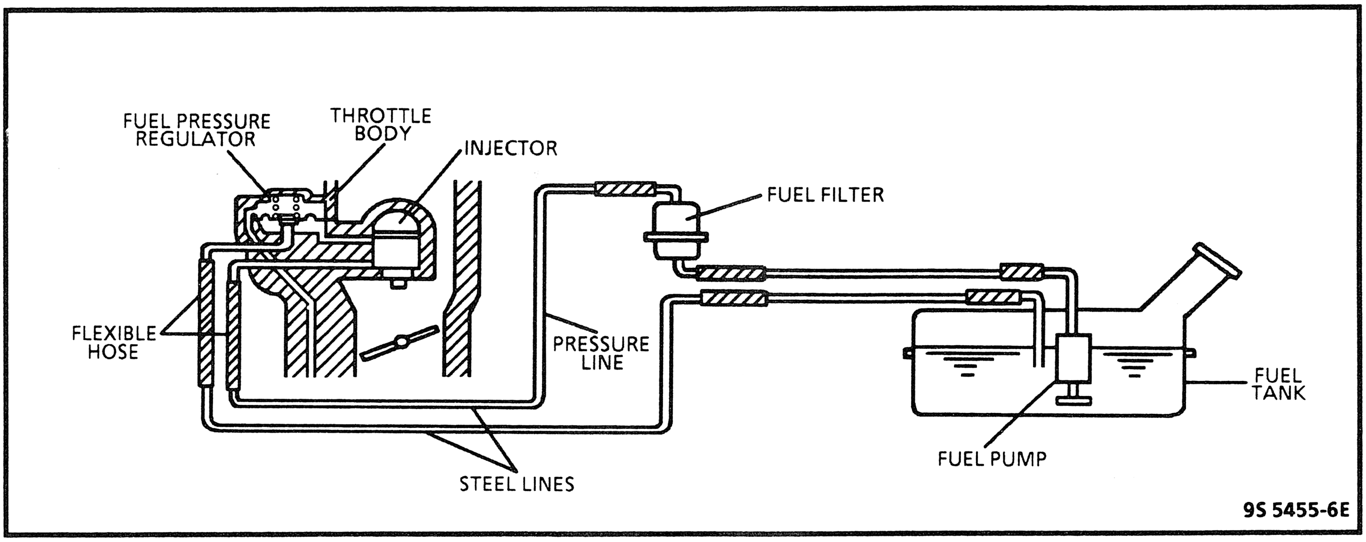


CHART A-7

(Page 2 of 3)

FUEL SYSTEM PRESSURE TEST

1.0L (VIN 6) "M" CARLINE (TBI)

Circuit Description:

When the ignition switch is turned "ON", the Electronic Control Module (ECM) will turn "ON" the in-tank fuel pump. It will remain "ON" as long as the engine is cranking or running, and the ECM is receiving reference pulses. If there are no reference pulses, the ECM will shut "OFF" the fuel pump in about 2 seconds after ignition "ON" or engine stops.

The pump will deliver fuel to the injector, then to the pressure regulator, where the system pressure is controlled to about 160-210 kPa (23.2-30.5 psi). Excess fuel is then returned to the fuel tank.

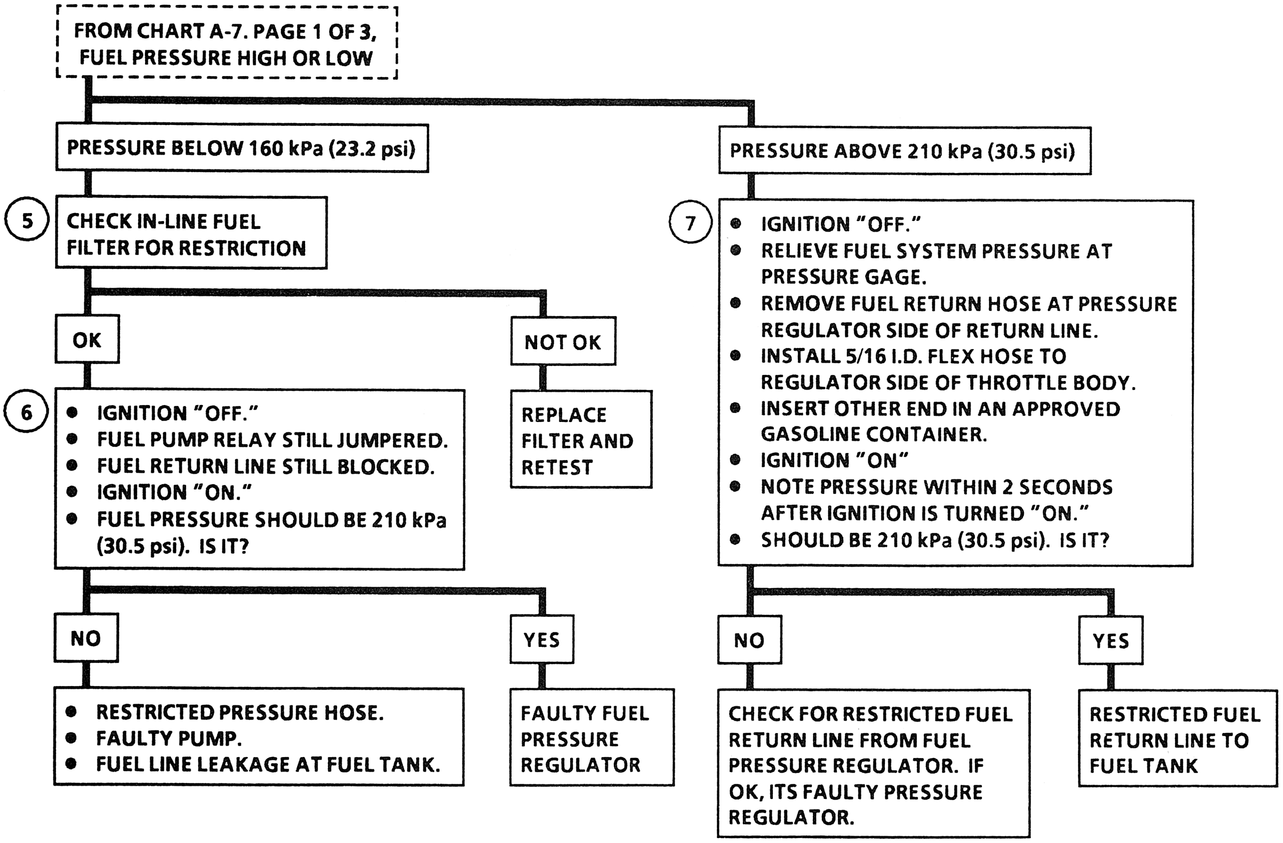
Test Description: Numbers below refer to circled numbers on the diagnostic chart.

5. Pressure below 160 kPa (23.2 psi) may cause a lean condition. It could also cause hard starting cold and poor driveability. Low enough pressure will cause the engine not to run at all. Restricted flow may allow the engine to run at idle, or low speeds but may cause a surge and stall when more fuel is required, as when accelerating or driving at high speeds.
6. Restricting the fuel return line allows the fuel pump to develop its maximum pressure (dead head pressure). When B+, volts is applied to the pump test terminal, pressure should be above 210 kPa (30.5 psi).
7. This test determines if the high fuel pressure is due to a restricted fuel return line or a pressure regulator problem.

CHART A-7

(Page 2 of 3)

FUEL SYSTEM PRESSURE TEST 1.0L (VIN 6) "M" CARLINE (TBI)



FROM CHART A-7. PAGE 1 OF 3, FUEL PRESSURE HIGH OR LOW

PRESSURE BELOW 160 kPa (23.2 psi)

⑤ CHECK IN-LINE FUEL FILTER FOR RESTRICTION

OK

⑥
- IGNITION "OFF."
- FUEL PUMP RELAY STILL JUMPERED.
- FUEL RETURN LINE STILL BLOCKED.
- IGNITION "ON."
- FUEL PRESSURE SHOULD BE 210 kPa (30.5 psi). IS IT?

NO

- RESTRICTED PRESSURE HOSE.
- FAULTY PUMP.
- FUEL LINE LEAKAGE AT FUEL TANK.

YES

FAULTY FUEL PRESSURE REGULATOR

NOT OK

REPLACE FILTER AND RETEST

PRESSURE ABOVE 210 kPa (30.5 psi)

⑦
- IGNITION "OFF."
- RELIEVE FUEL SYSTEM PRESSURE AT PRESSURE GAGE.
- REMOVE FUEL RETURN HOSE AT PRESSURE REGULATOR SIDE OF RETURN LINE.
- INSTALL 5/16 I.D. FLEX HOSE TO REGULATOR SIDE OF THROTTLE BODY.
- INSERT OTHER END IN AN APPROVED GASOLINE CONTAINER.
- IGNITION "ON"
- NOTE PRESSURE WITHIN 2 SECONDS AFTER IGNITION IS TURNED "ON."
- SHOULD BE 210 kPa (30.5 psi). IS IT?

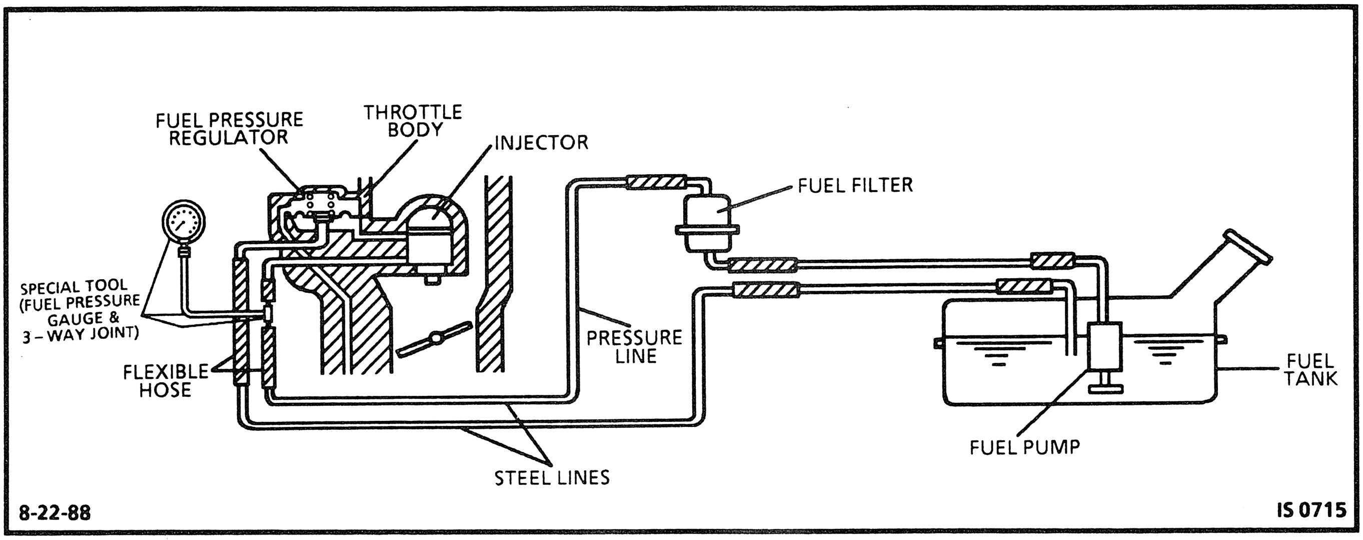
NO

CHECK FOR RESTRICTED FUEL RETURN LINE FROM FUEL PRESSURE REGULATOR. IF OK, ITS FAULTY PRESSURE REGULATOR.

YES

RESTRICTED FUEL RETURN LINE TO FUEL TANK

CLEAR CODES AND CONFIRM NO "CHECK ENGINE" LIGHT.


FUEL PRESSURE REGULATOR
THROTTLE BODY
INJECTOR
FUEL FILTER
SPECIAL TOOL (FUEL PRESSURE GAUGE & 3-WAY JOINT)
FLEXIBLE HOSE
PRESSURE LINE
STEEL LINES
FUEL TANK
FUEL PUMP

8-22-88

IS 0715

CHART A-7

(Page 3 of 3)

FUEL SYSTEM PRESSURE TEST

(FUEL PRESSURE GAGE INSTALLATION)

1.0L (VIN 6) "M" CARLINE (TBI)

Circuit Description:

The fuel system contains the following components: an ECM controlled relay, a fuel pump, and a throttle body with a pressure regulator. Care should be taken when servicing this system due to the high presure in the fuel lines.

Test Description:

This test is used to check the components for proper operation. When servicing the fuel system all procedures should be followed and care should be exercised to prevent personal injury or damage to the vehicles components. All procedures should be read through carefully and a through understanding of the procedure before performing the test procedures.

CHART A-7

(Page 3 of 3)

FUEL SYSTEM PRESSURE TEST

(FUEL PRESSURE GAGE INSTALLATION)

1.0L (VIN 6) "M" CARLINE (TBI)

FUEL PRESSURE RELIEF PROCEDURE

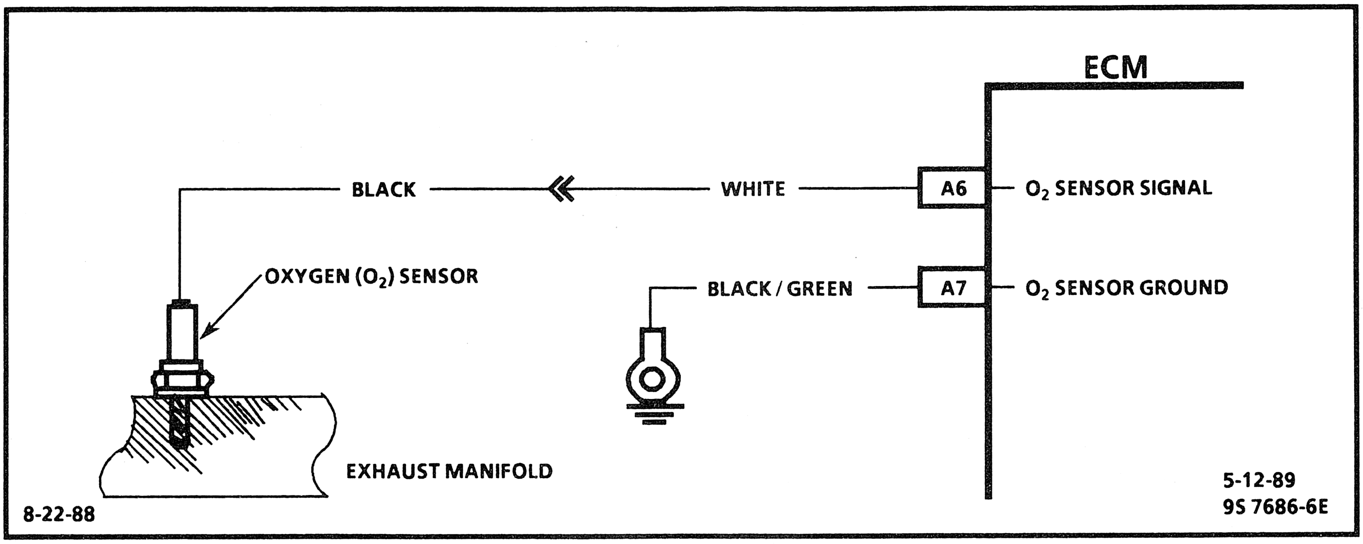
CAUTION:

- **To reduce the risk of fire and personal injury, it is necessary to relieve the fuel system pressure before servicing the fuel system.**
- **After relieving system pressure, a small amount of fuel may be released when servicing fuel lines or connections. In order to reduce the chance of personal injury, cover fuel line fittings with a shop towel before disconnecting, to catch any fuel that may leak out. Place the towel in an approved container when disconnect is completed.**

FUEL PRESSURE GAGE INSTALLATION

1. Loosen fuel filler cap to relieve tank vapor pressure.
2. Place transaxle gear shift lever in Neutral for M/T models, or Park for A/T models. Set parking brake and block drive wheels.
3. Remove main fuse block cover and engine coolant reservoir from its bracket.
4. Remove screws holding underhood fuse/relay block.
5. Remove connector holding fuel pump relay and disconnect.
6. Start engine and run till it stalls, crank engine for 3 seconds to insure there is no fuel left in lines.
7. Disconnect negative battery cable.
8. Remove air cleaner assembly.
9. Disconnect fuel feed hose from throttle body.
10. Install fuel pressure gauge (J 34730-1), and T-Fitting (J 34730-75) between fuel feed line and throttle body. Clamp securely to ensure that no leaks occur.
11. Reverse steps 3-4.

CLEAR CODES AND CONFIRM NO "CHECK ENGINE" LIGHT.



CODE 13

OXYGEN SENSOR CIRCUIT

(OPEN CIRCUIT)

1.0L (VIN 6) "M" CARLINE (TBI)

Circuit Description:

The Oxygen (O_2) sensor produces a varying voltage as engine temperature rises to normal operation. This voltage varies from 0 to 900 mV. The signal will vary depending on the exhaust gases. If the voltage stays above 450 mV, this indicates a rich condition. If voltage remains below 450 mV and does not vary a lean condition is indicated.

The O_2 sensor acts like an "open circuit" and produces no voltage when below 360°C (600°F). An open sensor circuit causes the engine to operate in an "open loop" operation.

Test Description: Numbers below refer to circled numbers on the diagnostic chart.

1. Running the engine above 1200 rpm keeps the oxygen sensor hot, so that an accurate check of the sensor can be performed.
2. This will check the O_2 Sensor.
3. Voltage above 900 mV and not varying indicates a short to voltage on O_2 sensor circuit.

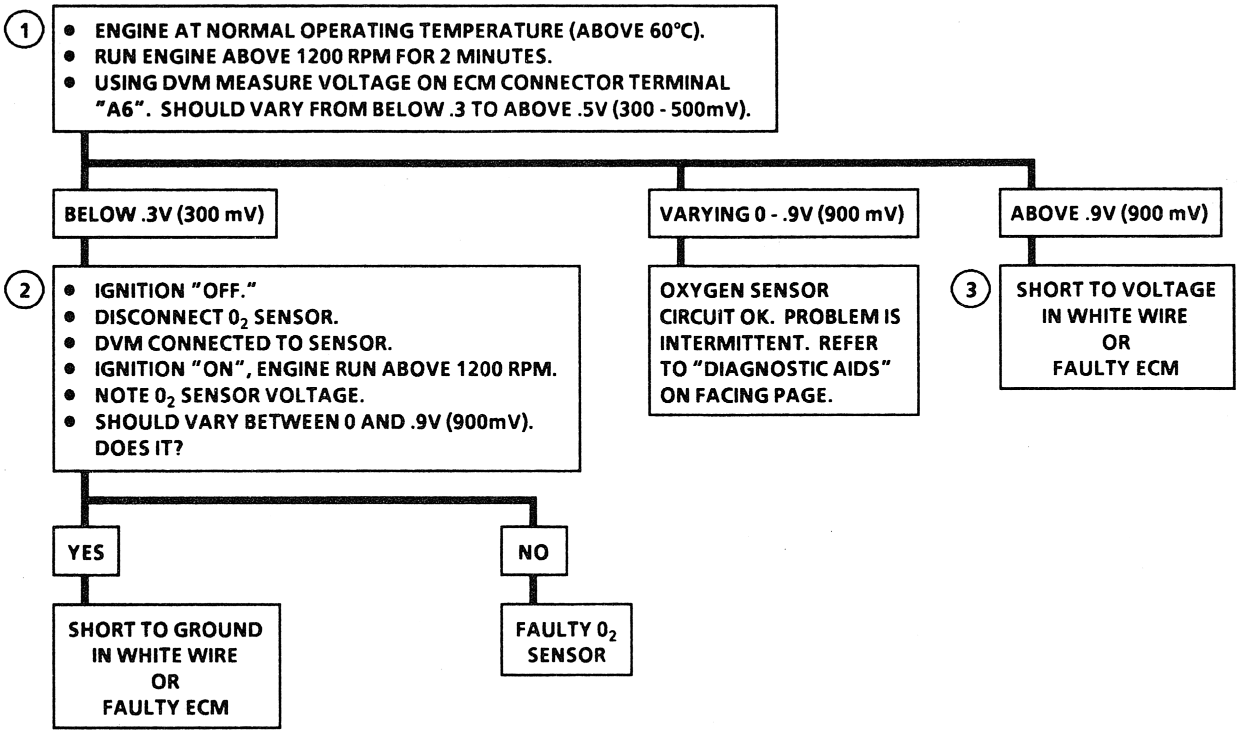
Diagnostic Aids:

Normal voltage varies between 0mV and 900mV. Code 13 will set if voltage is indicated low (0 volt) or high (900mV) all the time.

Refer to Section "Intermittents" in "Symptoms", "B."

CODE 13

OXYGEN SENSOR CIRCUIT
(OPEN CIRCUIT)
1.0L (VIN 6) "M" CARLINE (TBI)



①
- ENGINE AT NORMAL OPERATING TEMPERATURE (ABOVE 60°C).
- RUN ENGINE ABOVE 1200 RPM FOR 2 MINUTES.
- USING DVM MEASURE VOLTAGE ON ECM CONNECTOR TERMINAL "A6". SHOULD VARY FROM BELOW .3 TO ABOVE .5V (300 - 500mV).

BELOW .3V (300 mV)

②
- IGNITION "OFF."
- DISCONNECT 0_2 SENSOR.
- DVM CONNECTED TO SENSOR.
- IGNITION "ON", ENGINE RUN ABOVE 1200 RPM.
- NOTE 0_2 SENSOR VOLTAGE.
- SHOULD VARY BETWEEN 0 AND .9V (900mV). DOES IT?

YES

SHORT TO GROUND
IN WHITE WIRE
OR
FAULTY ECM

NO

FAULTY 0_2
SENSOR

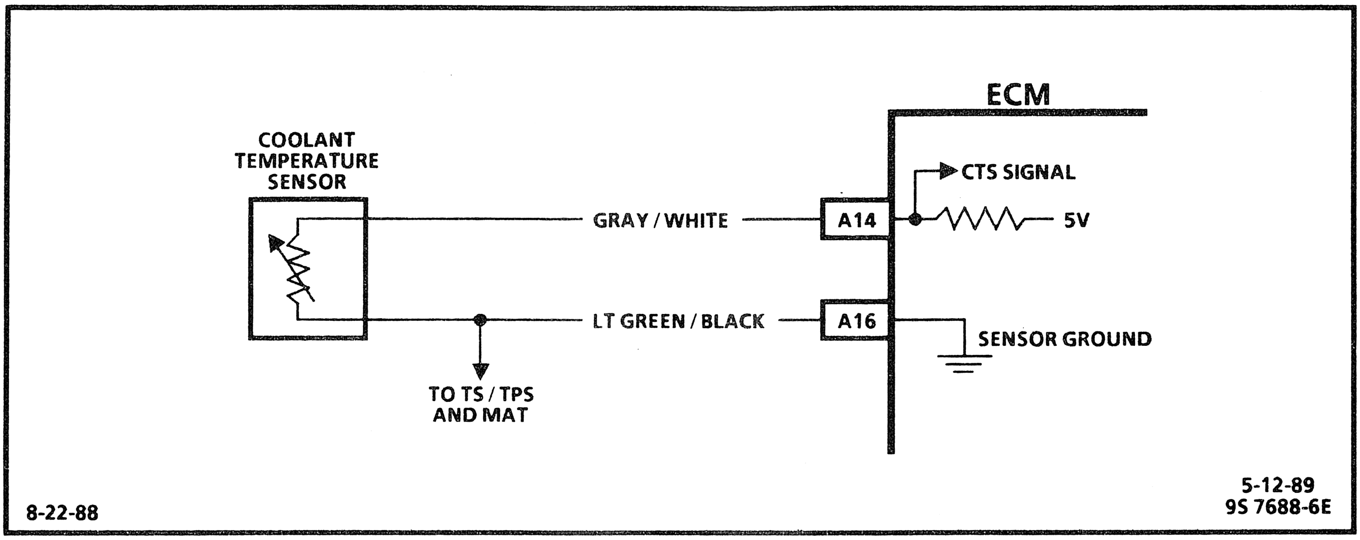
VARYING 0 - .9V (900 mV)

OXYGEN SENSOR CIRCUIT OK. PROBLEM IS INTERMITTENT. REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE.

ABOVE .9V (900 mV)

③ SHORT TO VOLTAGE
IN WHITE WIRE
OR
FAULTY ECM

CLEAR CODES AND CONFIRM NO "CHECK ENGINE" LIGHT.



CODE 14

COOLANT TEMPERATURE SENSOR (CTS) CIRCUIT

(LOW TEMPERATURE INDICATED)

1.0L (VIN 6) "M" CARLINE (TBI)

Circuit Description:

The Coolant Temperature Sensor (CTS) uses a thermistor to control the signal voltage to the ECM. The ECM applies a voltage on GRY/WHT wire to the sensor. When the engine is cold, the sensor (thermistor) resistance is high, therefore, ECM will see high signal voltage.

As the engine warms, the sensor resistance becomes less, and the voltage drops. At normal engine operating temperature (80°C to 95°C), the voltage will measure about 1.5 to 2.0 volts at the ECM.

Test Description: Numbers below refer to circled numbers on the diagnostic chart.

1. Code 14 will set if:
   - Signal voltage indicates a water temperature less than -48°C (-54°F) for 3 seconds.
2. This test simulates a Code 15. If the ECM recognizes the low signal and sets a Code 15, the ECM and wiring are OK. If Code 14 repeats, the problem is an open GRY/WHT wire or LT GRN/BLK wire, a poor connection at the ECM or sensor, or a faulty ECM.

Diagnostic Aids:

After engine is started the temperature should rise steadily to about 95°C then stabilize when thermostat opens.

A faulty connection, or an open in GRY/WHT wire or LT GRN/BLK wire can result in a Code 14.

Codes 14 and 22 stored at the same time could be the result of an open light GRN/BLK wire.

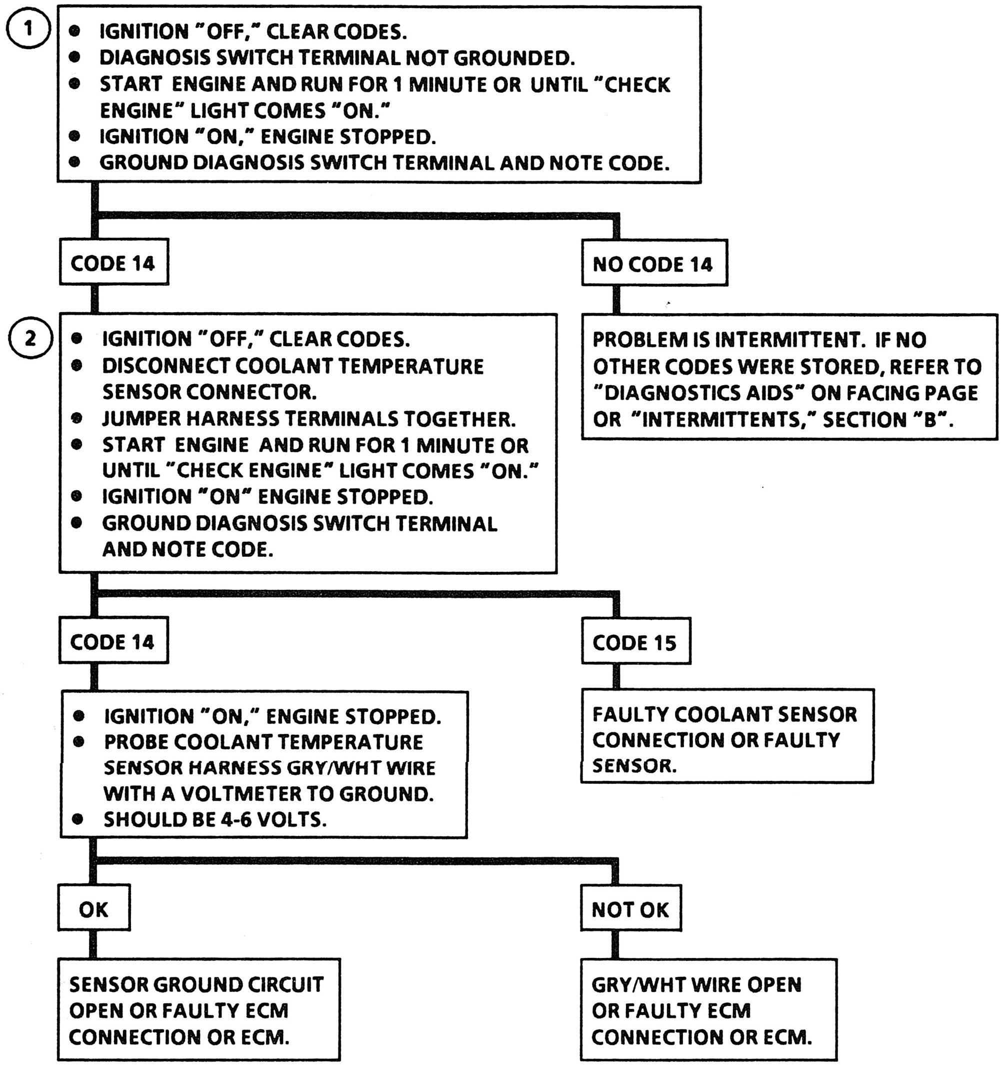
The "Temperature to Resistance Value" scale on Code 15 chart may be used to test the coolant temperature sensor at various temperature levels to evaluate the possibility of a "shifted" (mis-scaled) sensor. A "shifted" sensor could result in poor driveability complaints.

Refer to "Intermittents" in Section "B".

CODE 14

COOLANT TEMPERATURE SENSOR (CTS) CIRCUIT
(LOW TEMPERATURE INDICATED)
1.0L (VIN 6) "M" CARLINE (TBI)

NOTE: *IF CODE 22 IS PRESENT, REPAIR THAT CODE FIRST AND RECHECK FOR ADDITIONAL CODES.*



①
- IGNITION "OFF," CLEAR CODES.
- DIAGNOSIS SWITCH TERMINAL NOT GROUNDED.
- START ENGINE AND RUN FOR 1 MINUTE OR UNTIL "CHECK ENGINE" LIGHT COMES "ON."
- IGNITION "ON," ENGINE STOPPED.
- GROUND DIAGNOSIS SWITCH TERMINAL AND NOTE CODE.

CODE 14

②
- IGNITION "OFF," CLEAR CODES.
- DISCONNECT COOLANT TEMPERATURE SENSOR CONNECTOR.
- JUMPER HARNESS TERMINALS TOGETHER.
- START ENGINE AND RUN FOR 1 MINUTE OR UNTIL "CHECK ENGINE" LIGHT COMES "ON."
- IGNITION "ON" ENGINE STOPPED.
- GROUND DIAGNOSIS SWITCH TERMINAL AND NOTE CODE.

CODE 14

- IGNITION "ON," ENGINE STOPPED.
- PROBE COOLANT TEMPERATURE SENSOR HARNESS GRY/WHT WIRE WITH A VOLTMETER TO GROUND.
- SHOULD BE 4-6 VOLTS.

OK

SENSOR GROUND CIRCUIT OPEN OR FAULTY ECM CONNECTION OR ECM.

NOT OK

GRY/WHT WIRE OPEN OR FAULTY ECM CONNECTION OR ECM.

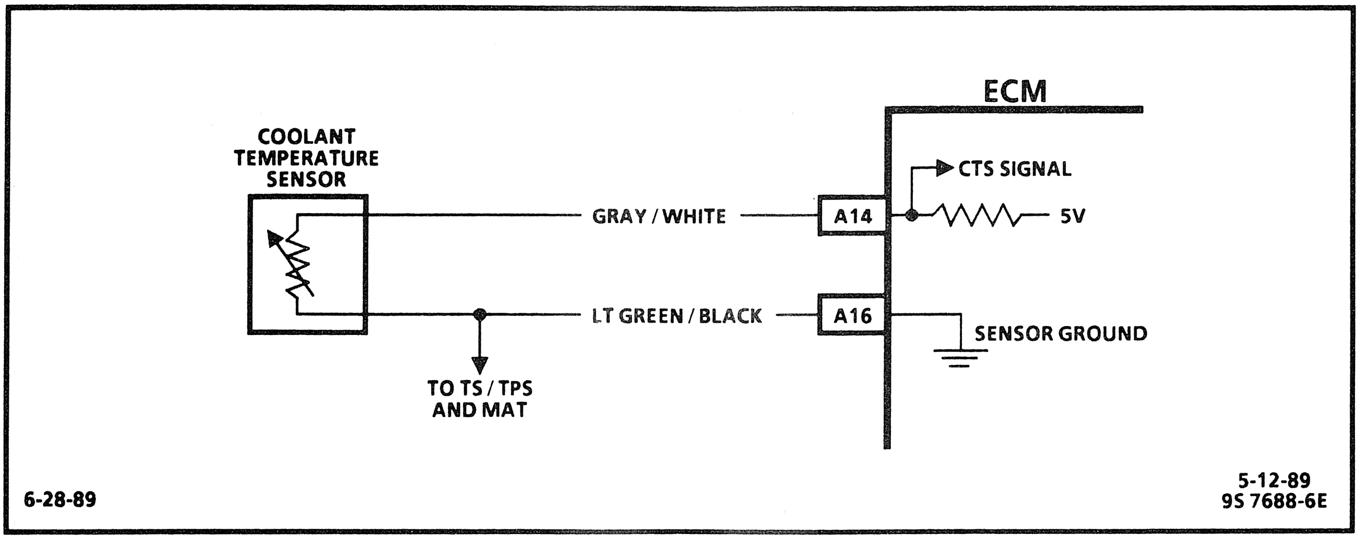
CODE 15

FAULTY COOLANT SENSOR CONNECTION OR FAULTY SENSOR.

NO CODE 14

PROBLEM IS INTERMITTENT. IF NO OTHER CODES WERE STORED, REFER TO "DIAGNOSTICS AIDS" ON FACING PAGE OR "INTERMITTENTS," SECTION "B".

CLEAR CODES AND CONFIRM NO "CHECK ENGINE" LIGHT.



CODE 15

COOLANT TEMPERATURE SENSOR (CTS) CIRCUIT

(HIGH TEMPERATURE INDICATED)

1.0L (VIN 6) "M" CARLINE (TBI)

Circuit Description:

The Coolant Temperature Sensor (CTS) uses a thermistor to control the signal voltage at the ECM. The ECM applies a voltage on GRY/WHT wire to the sensor. When the engine is cold the sensor (thermistor) resistance is high, therefore, ECM terminal "A14" voltage will be high.

As the engine warms, the sensor resistance becomes less, and the voltage drops. At normal engine operating temperature the voltage will measure about 1.5 to 2.0 volts at ECM terminal "A14".

Coolant temperature is one of the inputs used to control

- Fuel delivery
- Engine Spark Timing (EST)

Test Description: Numbers below refer to circled numbers on the diagnostic chart.

1. Code 15 will set if:
   - Signal voltage indicates a coolant temperature above 136°C (276°F) for 3 seconds.
2. This test will determine if GRY/WHT wire is shorted to ground which will cause the conditions for Code 15.

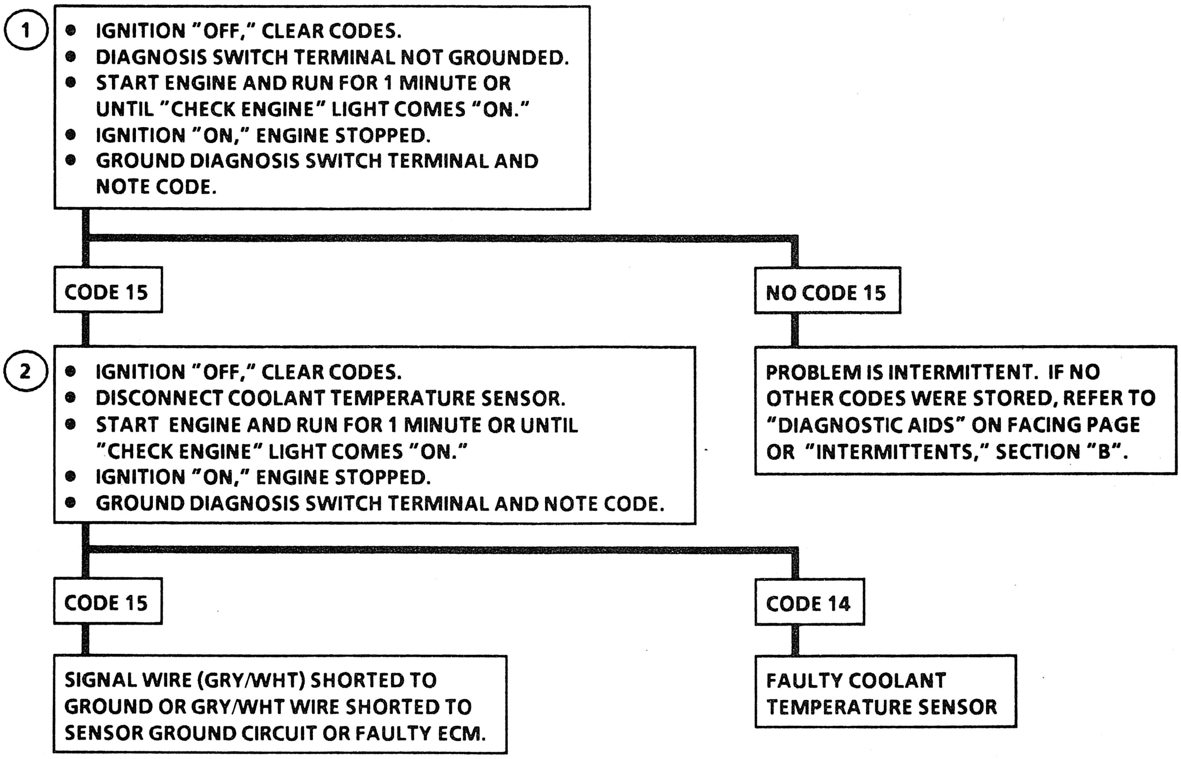
Diagnostic Aids:

Check harness routing for a potential short to ground in GRY/WHT wire circuit. After engine is started, the temperature should rise steadily to about 90°C then stabilize when thermostat opens. Refer to "Intermittents" in Section "B".

Verify that engine is not overheating and has not been subjected to conditions which could create an overheating condition (i.e. overload, trailer towing, hilly terrain, heavy stop and go traffic, etc.). The "Temperature To Resistance Value" scale at the right may be used to test the coolant sensor at various temperature levels to evaluate the possibility of a "shifted" (mis-scaled) sensor. A "shifted" sensor could result in poor driveability complaints.

CODE 15

COOLANT TEMPERATURE SENSOR (CTS) CIRCUIT
(HIGH TEMPERATURE INDICATED)
1.0L (VIN 6) "M" CARLINE (TBI)



①
- IGNITION "OFF," CLEAR CODES.
- DIAGNOSIS SWITCH TERMINAL NOT GROUNDED.
- START ENGINE AND RUN FOR 1 MINUTE OR UNTIL "CHECK ENGINE" LIGHT COMES "ON."
- IGNITION "ON," ENGINE STOPPED.
- GROUND DIAGNOSIS SWITCH TERMINAL AND NOTE CODE.

CODE 15

NO CODE 15

PROBLEM IS INTERMITTENT. IF NO OTHER CODES WERE STORED, REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE OR "INTERMITTENTS," SECTION "B".

②
- IGNITION "OFF," CLEAR CODES.
- DISCONNECT COOLANT TEMPERATURE SENSOR.
- START ENGINE AND RUN FOR 1 MINUTE OR UNTIL "CHECK ENGINE" LIGHT COMES "ON."
- IGNITION "ON," ENGINE STOPPED.
- GROUND DIAGNOSIS SWITCH TERMINAL AND NOTE CODE.

CODE 15

SIGNAL WIRE (GRY/WHT) SHORTED TO GROUND OR GRY/WHT WIRE SHORTED TO SENSOR GROUND CIRCUIT OR FAULTY ECM.

CODE 14

FAULTY COOLANT TEMPERATURE SENSOR

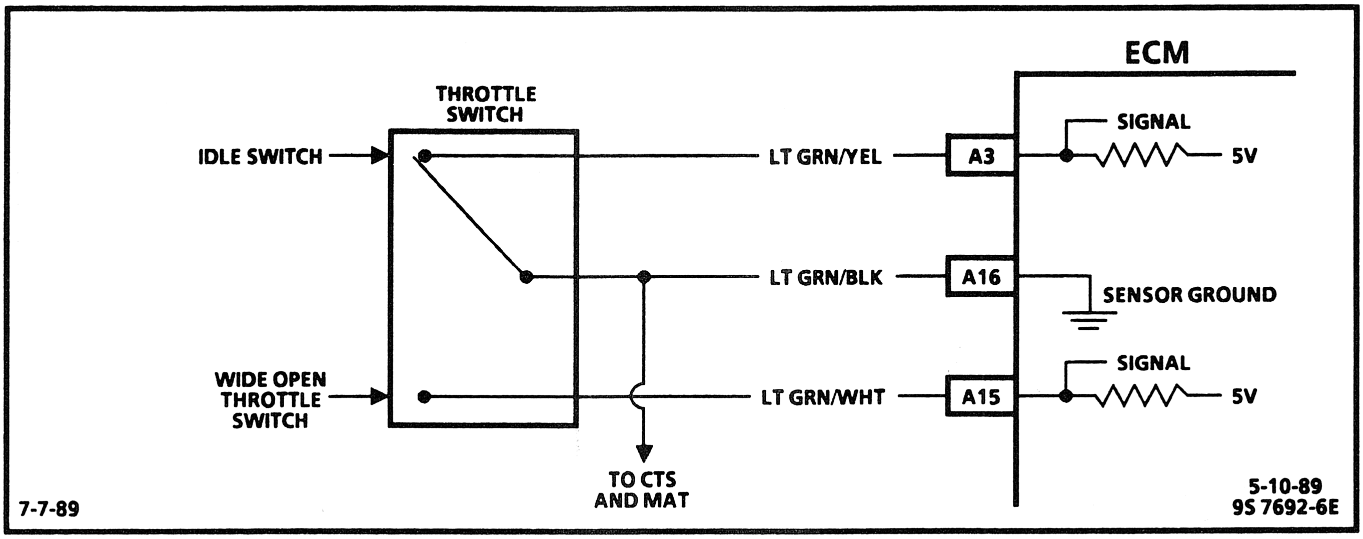
DIAGNOSTIC AID

COOLANT TEMPERATURE SENSOR

TEMPERATURE TO RESISTANCE VALUES (APPROXIMATE)

°F	°C	OHMS
210	100	185
160	70	450
100	38	1,800
70	20	3,400
40	4	7,500
20	-7	13,500
0	-18	25,000
-40	-40	100,700

CLEAR CODES AND CONFIRM NO "CHECK ENGINE" LIGHT.


ECM
THROTTLE SWITCH
IDLE SWITCH
WIDE OPEN THROTTLE SWITCH
LT GRN/YEL
LT GRN/BLK
LT GRN/WHT
A3
A16
A15
SIGNAL
5V
SENSOR GROUND
SIGNAL
5V
TO CTS AND MAT
7-7-89
5-10-89
9S 7692-6E

CODE 21

THROTTLE SWITCH CIRCUIT - M/T ONLY

(BOTH IDLE SWITCH AND WIDE OPEN THROTTLE SWITCH INDICATED "ON")

1.0L (VIN 6) "M" CARLINE (TBI)

Circuit Description:

On vehicles equipped with a manual transaxle, the ECM supplies 4-5 volts to a throttle switch on the throttle body. When engine is idling, the ECM senses a low voltage signal at terminal "A3." At slight throttle the ECM will see a high voltage signal at terminal "A3". At wide open throttle the signal voltage on terminal "A15" is low. Code 21 will set if the ECM sees the signal voltage at terminals "A3" and "A15" remain above 4-9 volts, at the same time, for more than .3 seconds (indicating idle and WOT simultaneously).

Test Description: Numbers below refer to circled numbers on the diagnostic chart.

1. The ECM supplies 5 volts to the throttle switch. A poor connection or ground circuit will indicate a low signal.
2. This will check circuit for short to ground or misadjusted throttle switch.
3. Section "C2" checks throttle switch adjustment.

Diagnostic Aids:

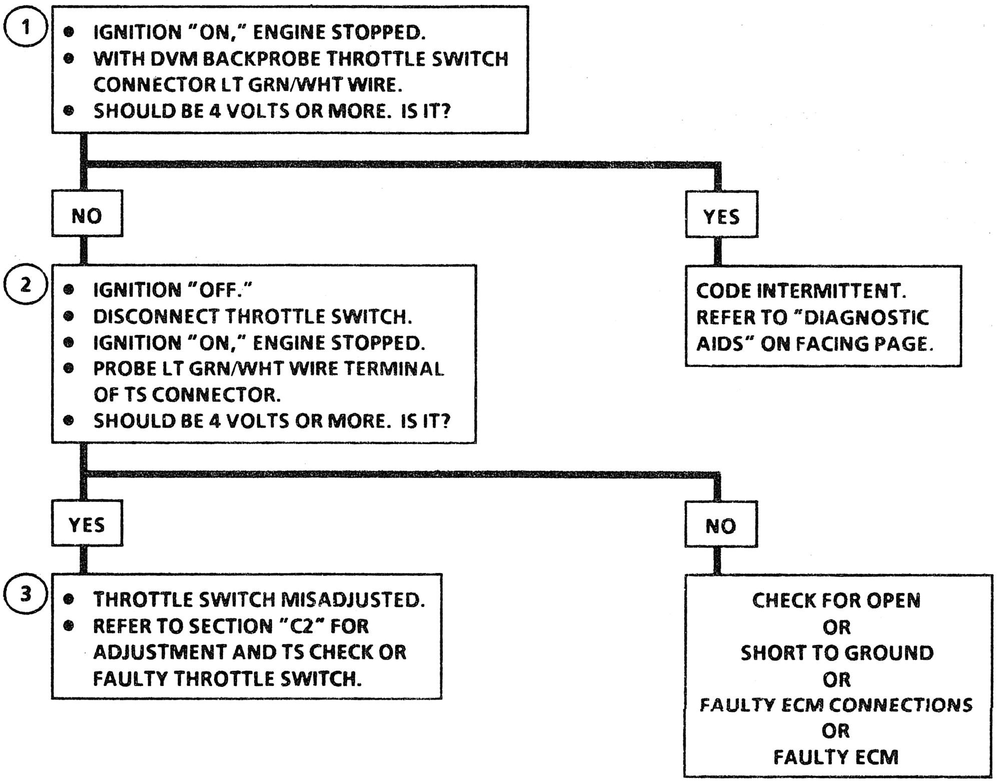
An intermittent may be caused by a poor connection rubbed through wire insulation or a wire broken inside the insulation. Inspect ECM harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal to wire connection and damaged harness. Refer to "Symptoms" Section "B", on Intermittents for additional information.

CODE 21

THROTTLE SWITCH CIRCUIT - M/T ONLY

(BOTH IDLE SWITCH AND WIDE OPEN THROTTLE SWITCH INDICATED "ON")

1.0L (VIN 6) "M" CARLINE (TBI)



①
- IGNITION "ON," ENGINE STOPPED.
- WITH DVM BACKPROBE THROTTLE SWITCH CONNECTOR LT GRN/WHT WIRE.
- SHOULD BE 4 VOLTS OR MORE. IS IT?

NO

②
- IGNITION "OFF."
- DISCONNECT THROTTLE SWITCH.
- IGNITION "ON," ENGINE STOPPED.
- PROBE LT GRN/WHT WIRE TERMINAL OF TS CONNECTOR.
- SHOULD BE 4 VOLTS OR MORE. IS IT?

YES

CODE INTERMITTENT. REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE.

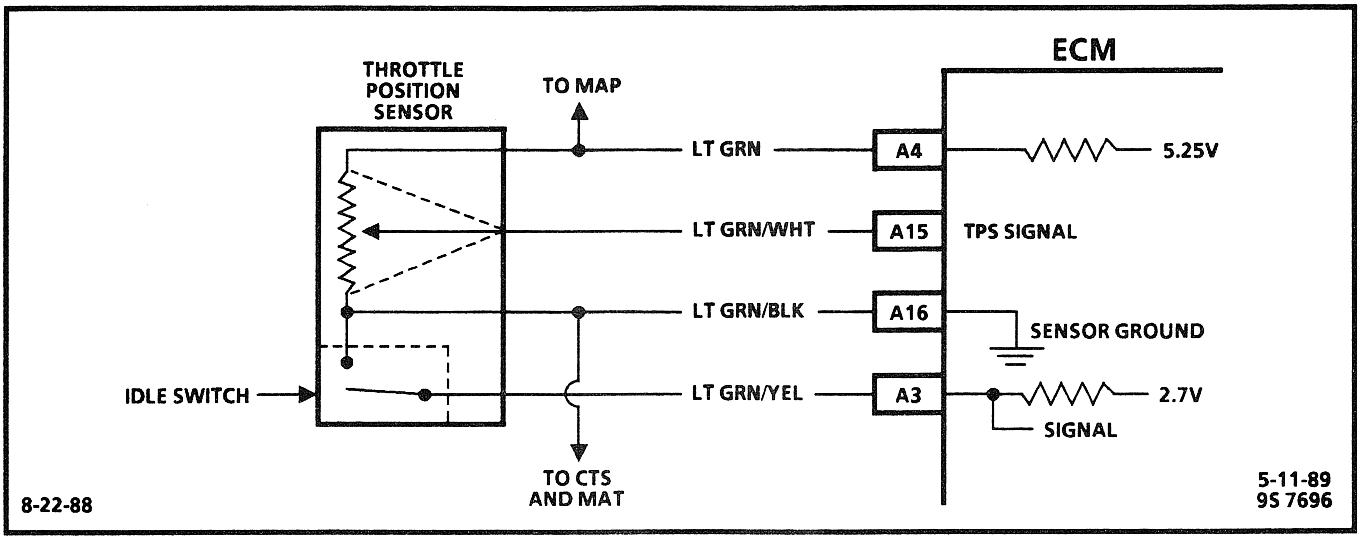
YES

③
- THROTTLE SWITCH MISADJUSTED.
- REFER TO SECTION "C2" FOR ADJUSTMENT AND TS CHECK OR FAULTY THROTTLE SWITCH.

NO

CHECK FOR OPEN
OR
SHORT TO GROUND
OR
FAULTY ECM CONNECTIONS
OR
FAULTY ECM

CLEAR CODES AND CONFIRM NO "CHECK ENGINE" LIGHT.


THROTTLE POSITION SENSOR
TO MAP
ECM
LT GRN
A4
5.25V
LT GRN/WHT
A15
TPS SIGNAL
LT GRN/BLK
A16
SENSOR GROUND
IDLE SWITCH
LT GRN/YEL
A3
2.7V
SIGNAL
TO CTS AND MAT
8-22-88
5-11-89
9S 7696

CODE 21

THROTTLE POSITION SENSOR (TPS) CIRCUIT - A/T ONLY

(SIGNAL VOLTAGE HIGH)

1.0L (VIN 6) "M" CARLINE (TBI)

Circuit Description:

The Throttle Position Sensor (TPS) provides a voltage signal that changes relative to the throttle opening. Signal voltage will vary from about .5 volt at idle to about 5 volts at Wide Open Throttle (WOT).

The TPS signal is one of the most important inputs used by the ECM for fuel control and for most of the ECM control outputs.

Test Description: Numbers below refer to circled numbers on the diagnostic chart.

1. Code 21 will set if:
   - Engine is running.
   - TPS signal voltage greater than approximately 4.9 volts.
   - Above conditions exist for over .7 seconds.
2. With the TPS disconnected, the TPS voltage should go low if the ECM and wiring are OK.
3. Probing light GRN/BLK wire with a test light checks the TPS ground circuit because an open or very high resistance ground circuit will cause a Code 21.

Diagnostic Aids:

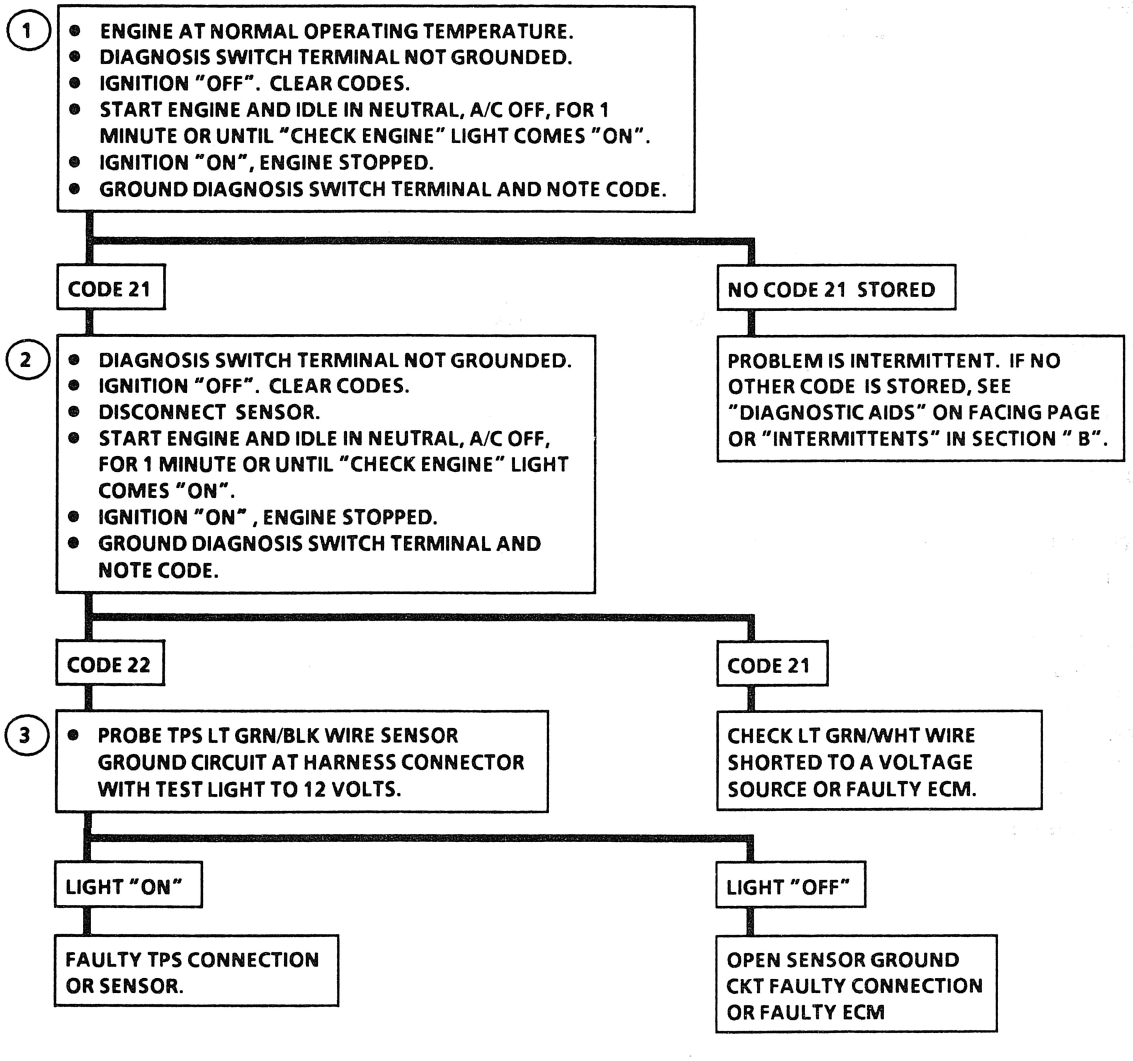
Using a DVM to measure TPS voltage, the voltage should vary between .54 volt ± .05 volt at closed throttle and 5 volts ± .05 volt at Wide Open Throttle (WOT).

CODE 21

THROTTLE POSITION SENSOR (TPS) CIRCUIT - A/T ONLY

(SIGNAL VOLTAGE HIGH)

1.0L (VIN 6) "M" CARLINE (TBI)



①
- ENGINE AT NORMAL OPERATING TEMPERATURE.
- DIAGNOSIS SWITCH TERMINAL NOT GROUNDED.
- IGNITION "OFF". CLEAR CODES.
- START ENGINE AND IDLE IN NEUTRAL, A/C OFF, FOR 1 MINUTE OR UNTIL "CHECK ENGINE" LIGHT COMES "ON".
- IGNITION "ON", ENGINE STOPPED.
- GROUND DIAGNOSIS SWITCH TERMINAL AND NOTE CODE.

CODE 21

②
- DIAGNOSIS SWITCH TERMINAL NOT GROUNDED.
- IGNITION "OFF". CLEAR CODES.
- DISCONNECT SENSOR.
- START ENGINE AND IDLE IN NEUTRAL, A/C OFF, FOR 1 MINUTE OR UNTIL "CHECK ENGINE" LIGHT COMES "ON".
- IGNITION "ON", ENGINE STOPPED.
- GROUND DIAGNOSIS SWITCH TERMINAL AND NOTE CODE.

CODE 22

③
- PROBE TPS LT GRN/BLK WIRE SENSOR GROUND CIRCUIT AT HARNESS CONNECTOR WITH TEST LIGHT TO 12 VOLTS.

LIGHT "ON"

FAULTY TPS CONNECTION OR SENSOR.

LIGHT "OFF"

OPEN SENSOR GROUND CKT FAULTY CONNECTION OR FAULTY ECM

CODE 21

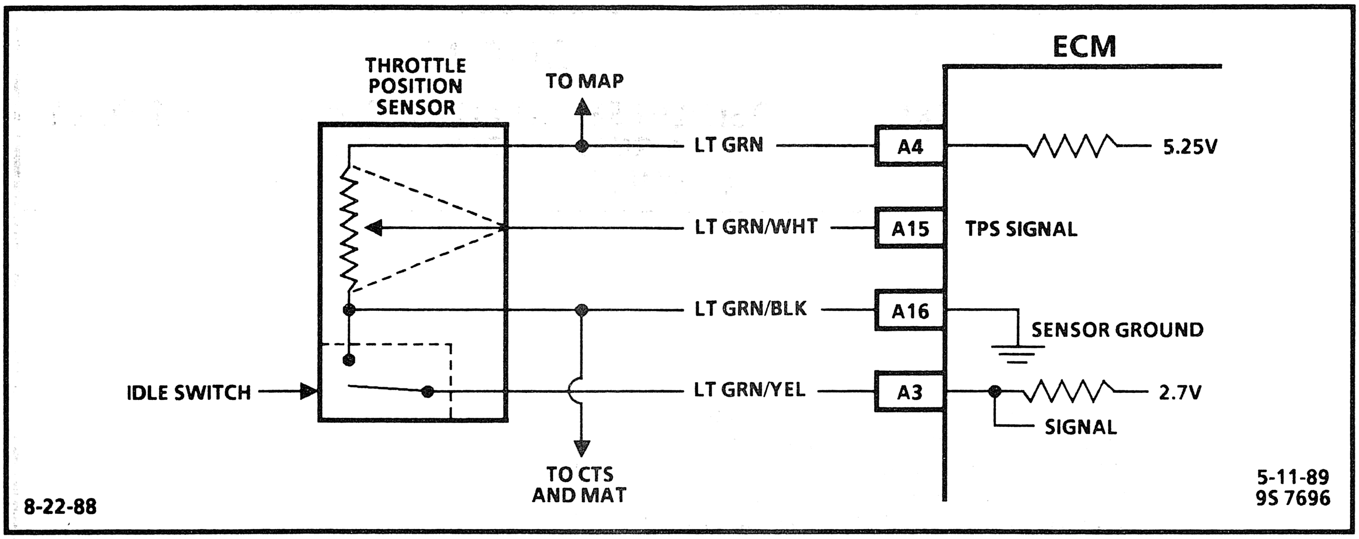
CHECK LT GRN/WHT WIRE SHORTED TO A VOLTAGE SOURCE OR FAULTY ECM.

NO CODE 21 STORED

PROBLEM IS INTERMITTENT. IF NO OTHER CODE IS STORED, SEE "DIAGNOSTIC AIDS" ON FACING PAGE OR "INTERMITTENTS" IN SECTION " B".

CLEAR CODES AND CONFIRM NO "CHECK ENGINE" LIGHT.

5-11-89
9S 7697


ECM
THROTTLE POSITION SENSOR
TO MAP
LT GRN
A4
5.25V
LT GRN/WHT
A15
TPS SIGNAL
LT GRN/BLK
A16
SENSOR GROUND
IDLE SWITCH
LT GRN/YEL
A3
2.7V
SIGNAL
TO CTS AND MAT
8-22-88
5-11-89
9S 7696

CODE 22

THROTTLE POSITION SENSOR (TPS) CIRCUIT - A/T ONLY

(SIGNAL VOLTAGE LOW)

1.0L (VIN 6) "M" CARLINE (TBI)

Circuit Description:

The Throttle Position Sensor (TPS) provides a voltage signal that changes relative to the throttle blade. Signal voltage will vary from about .5 volt at idle to about 5 volts at wide open throttle.

The TPS signal is one of the most important inputs used by the ECM for fuel control and for most of the ECM control outputs.

Test Description: Numbers below refer to circled numbers on the diagnostic chart.

1. Code 22 will set if:
   - Engine is running.
   - TPS signal voltage is less than about .1 volt for .7 seconds.
2. Simulates Code 21: (high voltage). If the ECM recognizes the high signal voltage, the ECM and wiring are OK.
3. Checks for reference voltage from the ECM.

Diagnostic Aids:

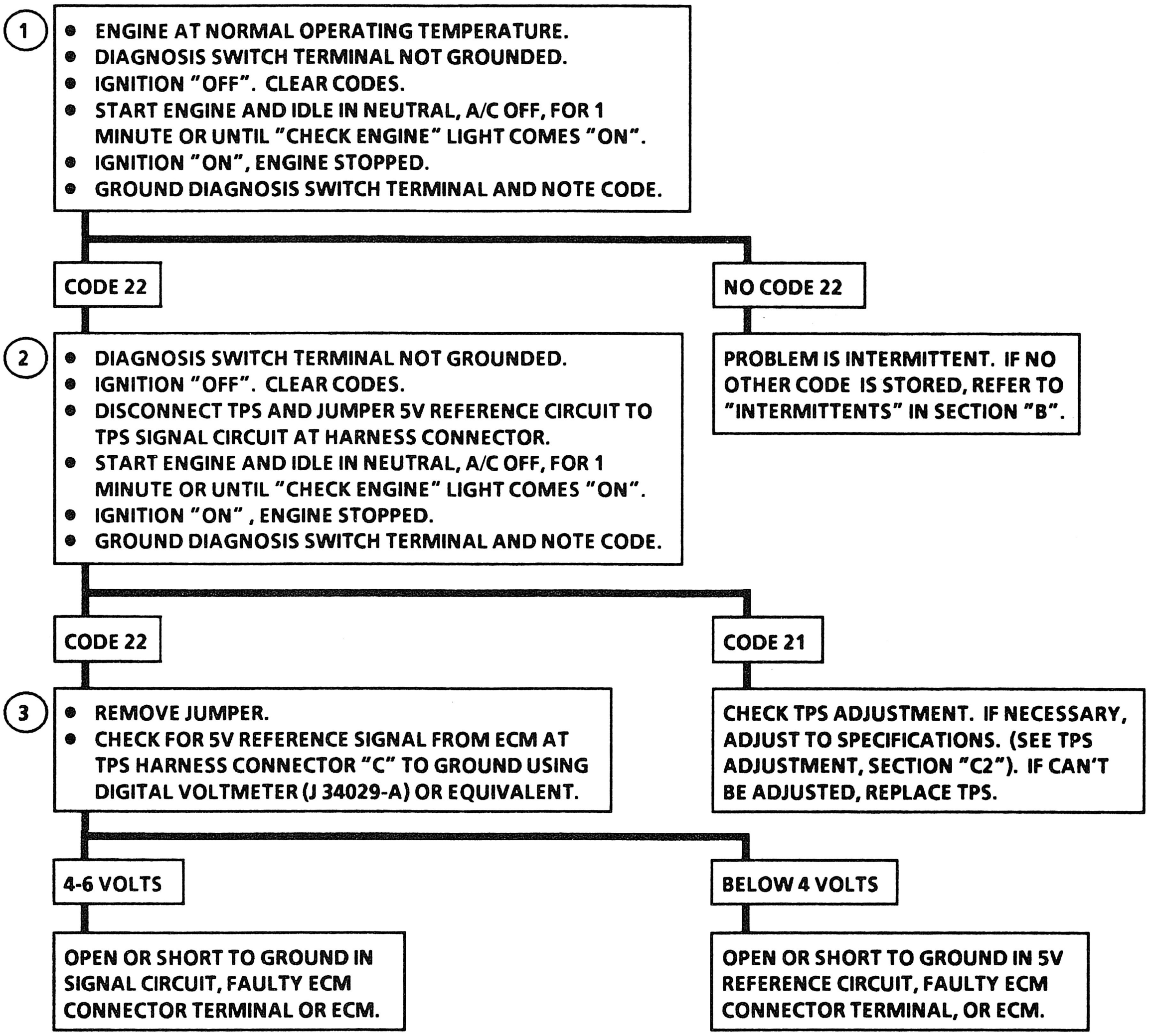
An intermittent may be caused by a poor connection rubbed through wire insulation or a wire broken inside the insulation. Inspect ECM harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal to wire connection and damaged harness.

CODE 22

THROTTLE POSITION SENSOR (TPS) CIRCUIT - A/T ONLY

(SIGNAL VOLTAGE LOW)

1.0L (VIN 6) "M" CARLINE (TBI)



①
- ENGINE AT NORMAL OPERATING TEMPERATURE.
- DIAGNOSIS SWITCH TERMINAL NOT GROUNDED.
- IGNITION "OFF". CLEAR CODES.
- START ENGINE AND IDLE IN NEUTRAL, A/C OFF, FOR 1 MINUTE OR UNTIL "CHECK ENGINE" LIGHT COMES "ON".
- IGNITION "ON", ENGINE STOPPED.
- GROUND DIAGNOSIS SWITCH TERMINAL AND NOTE CODE.

CODE 22

②
- DIAGNOSIS SWITCH TERMINAL NOT GROUNDED.
- IGNITION "OFF". CLEAR CODES.
- DISCONNECT TPS AND JUMPER 5V REFERENCE CIRCUIT TO TPS SIGNAL CIRCUIT AT HARNESS CONNECTOR.
- START ENGINE AND IDLE IN NEUTRAL, A/C OFF, FOR 1 MINUTE OR UNTIL "CHECK ENGINE" LIGHT COMES "ON".
- IGNITION "ON" , ENGINE STOPPED.
- GROUND DIAGNOSIS SWITCH TERMINAL AND NOTE CODE.

CODE 22

③
- REMOVE JUMPER.
- CHECK FOR 5V REFERENCE SIGNAL FROM ECM AT TPS HARNESS CONNECTOR "C" TO GROUND USING DIGITAL VOLTMETER (J 34029-A) OR EQUIVALENT.

4-6 VOLTS

OPEN OR SHORT TO GROUND IN SIGNAL CIRCUIT, FAULTY ECM CONNECTOR TERMINAL OR ECM.

BELOW 4 VOLTS

OPEN OR SHORT TO GROUND IN 5V REFERENCE CIRCUIT, FAULTY ECM CONNECTOR TERMINAL, OR ECM.

CODE 21

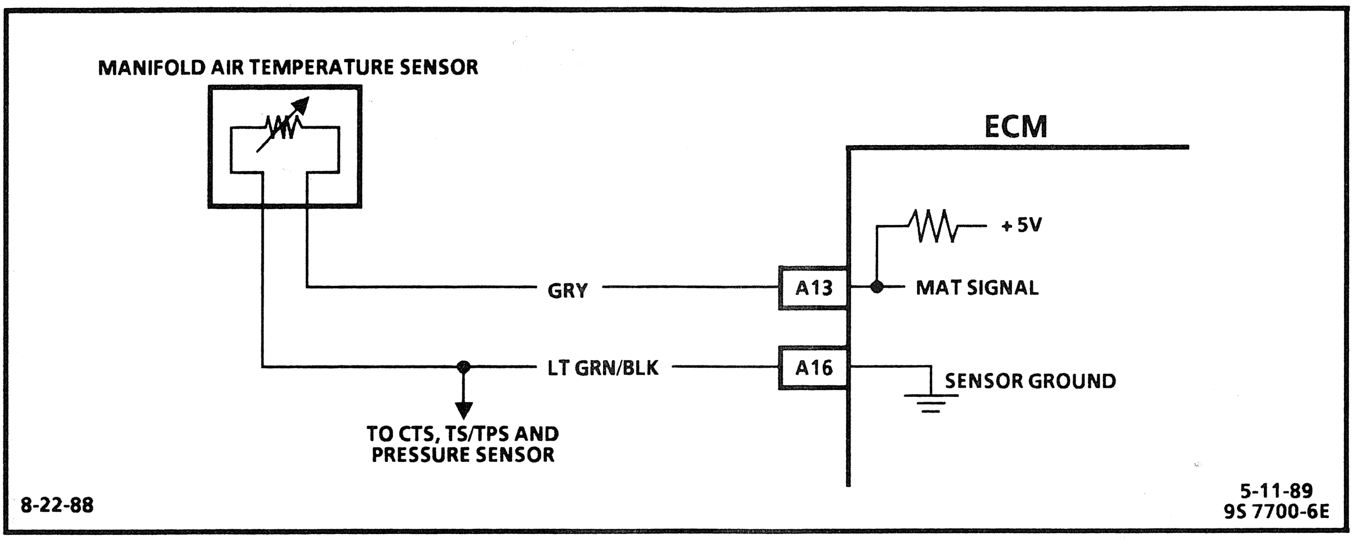
CHECK TPS ADJUSTMENT. IF NECESSARY, ADJUST TO SPECIFICATIONS. (SEE TPS ADJUSTMENT, SECTION "C2"). IF CAN'T BE ADJUSTED, REPLACE TPS.

NO CODE 22

PROBLEM IS INTERMITTENT. IF NO OTHER CODE IS STORED, REFER TO "INTERMITTENTS" IN SECTION "B".

CLEAR CODES AND CONFIRM NO "CHECK ENGINE" LIGHT.

7-6-89
9S 7699-6E


MANIFOLD AIR TEMPERATURE SENSOR
ECM
+5V
GRY
A13
MAT SIGNAL
LT GRN/BLK
A16
SENSOR GROUND
TO CTS, TS/TPS AND PRESSURE SENSOR
8-22-88
5-11-89
9S 7700-6E

CODE 23

MANIFOLD AIR TEMPERATURE (MAT) SENSOR CIRCUIT

(LOW TEMPERATURE INDICATED)

1.0L (VIN 6) "M" CARLINE (TBI)

Circuit Description:

The Manifold Air Temperature (MAT) sensor uses a thermistor to control the signal voltage at the ECM. The ECM applies a voltage (4-6 volts) on gray wire to the sensor. When the air is cold, the sensor (thermistor) resistance is high, therefore, the ECM will see a high signal voltage. If the air is warm, the sensor resistance is low, therefore, the ECM will see a low voltage.

Test Description: Numbers below refer to circled numbers on the diagnostic chart.

1. Code 23 will set if:
   - A signal voltage indicates a manifold air temperature below -48°C (-54.4°F) for 2.7 seconds.

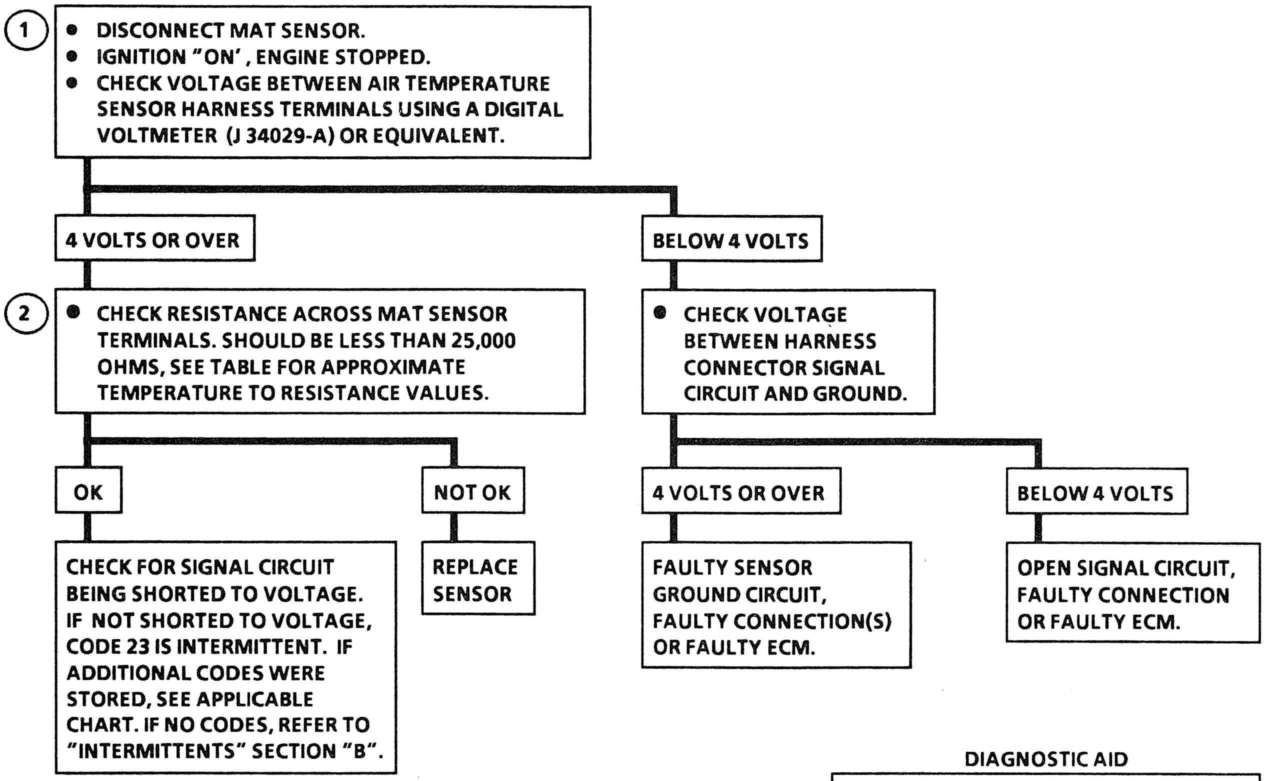
   A Code 23 will set, due to an open sensor, wire, or connection. This test will determine if the wiring and ECM are OK.
2. If the resistance is greater than 25,000 OHMS, replace the sensor.

Diagnostic Aids:

An intermittent may be caused by a poor connection rubbed through wire insulation or a wire broken inside the insulation. Inspect ECM harness connectors for backed out terminals "A13" or "A16", improper mating, broken locks, improperly formed or damaged terminals, poor terminal to wire connection and damaged harness.

CODE 23

MANIFOLD AIR TEMPERATURE (MAT) SENSOR CIRCUIT
(LOW TEMPERATURE INDICATED)
1.0L (VIN 6) "M" CARLINE (TBI)



①
- DISCONNECT MAT SENSOR.
- IGNITION "ON', ENGINE STOPPED.
- CHECK VOLTAGE BETWEEN AIR TEMPERATURE SENSOR HARNESS TERMINALS USING A DIGITAL VOLTMETER (J 34029-A) OR EQUIVALENT.

4 VOLTS OR OVER

②
- CHECK RESISTANCE ACROSS MAT SENSOR TERMINALS. SHOULD BE LESS THAN 25,000 OHMS, SEE TABLE FOR APPROXIMATE TEMPERATURE TO RESISTANCE VALUES.

OK

CHECK FOR SIGNAL CIRCUIT BEING SHORTED TO VOLTAGE. IF NOT SHORTED TO VOLTAGE, CODE 23 IS INTERMITTENT. IF ADDITIONAL CODES WERE STORED, SEE APPLICABLE CHART. IF NO CODES, REFER TO "INTERMITTENTS" SECTION "B".

NOT OK

REPLACE SENSOR

BELOW 4 VOLTS

- CHECK VOLTAGE BETWEEN HARNESS CONNECTOR SIGNAL CIRCUIT AND GROUND.

4 VOLTS OR OVER

FAULTY SENSOR GROUND CIRCUIT, FAULTY CONNECTION(S) OR FAULTY ECM.

BELOW 4 VOLTS

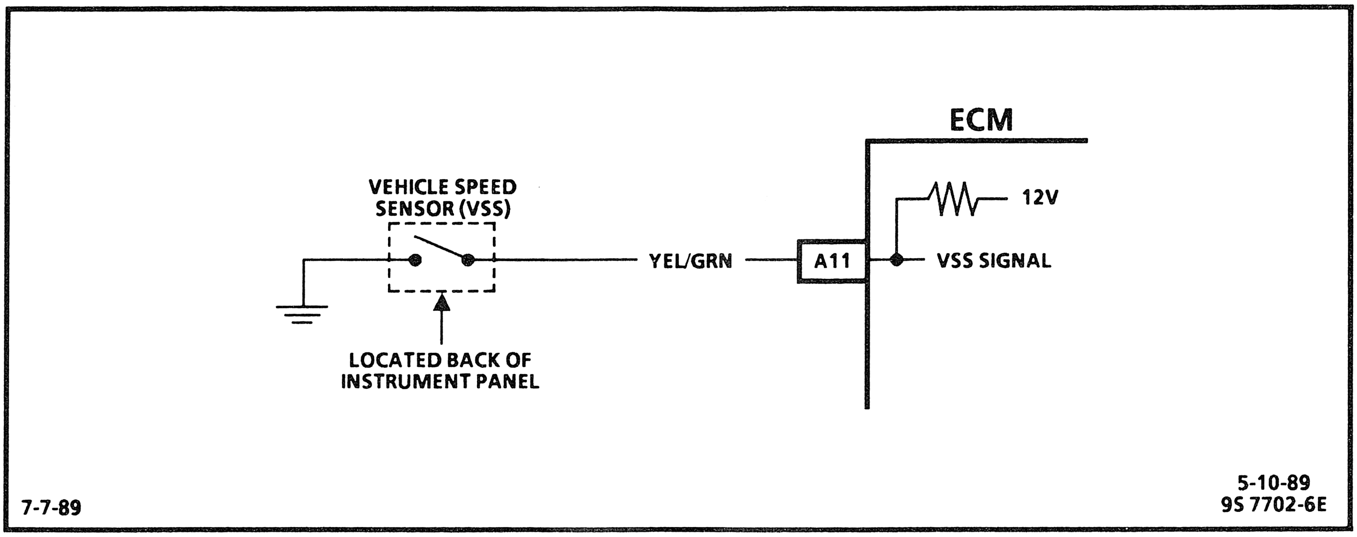
OPEN SIGNAL CIRCUIT, FAULTY CONNECTION OR FAULTY ECM.

DIAGNOSTIC AID

MAT SENSOR
TEMPERATURE TO RESISTANCE VALUES
(APPROXIMATE)

°F	°C	OHMS
210	100	185
160	70	450
100	38	1,800
70	20	3,400
40	4	7,500
20	-7	13,500
0	-18	25,000
-40	-40	100,700

CLEAR CODES AND CONFIRM NO "CHECK ENGINE" LIGHT.



CODE 24

VEHICLE SPEED SENSOR (VSS) CIRCUIT
1.0L (VIN 6) "M" CARLINE (TBI)

Circuit Description:

The ECM provides a B+signal to the Vehicle Speed Sensor (VSS). While the vehicle is moving, the reed switch within the VSS will open and close, which in turn will toggle the B+ signal high and low.

Test Description: Numbers below refer to circled numbers on the diagnostic chart.

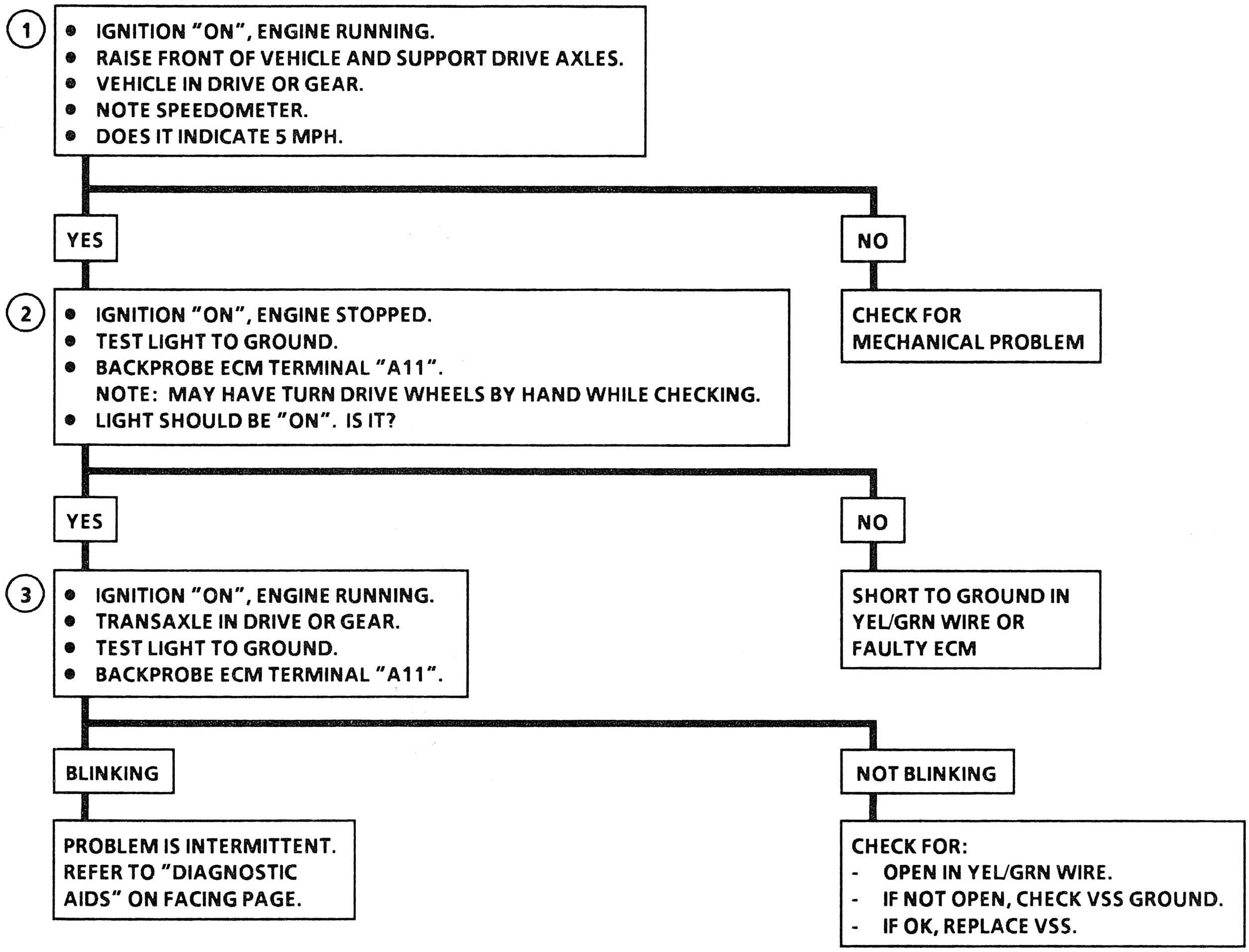
1. If speedometer does not work, it could be the cause of Code 24.
2. The ECM supplies B+ to the VSS.
3. The vehicle speed sensor on the back of the instrument panel will toggle the 12 volts supplied by the ECM.
   Code 24 will set if:
   - Fuel remains cut for 4 seconds or more.
   - RPM is below 4000.
   - Less than 1 mile / hr. (1.1 km/hr.) is sensed.

Diagnostic Aids:

An intermittent may be caused by a poor connection rubbed through wire insulation or a wire broken inside the insulation. Inspect ECM harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal to wire connection and damaged harness. If no trouble found and Code 24 resets, replace ECM.

CODE 24

VEHICLE SPEED SENSOR (VSS) CIRCUIT
1.0L (VIN 6) "M" CARLINE (TBI)



①
- IGNITION "ON", ENGINE RUNNING.
- RAISE FRONT OF VEHICLE AND SUPPORT DRIVE AXLES.
- VEHICLE IN DRIVE OR GEAR.
- NOTE SPEEDOMETER.
- DOES IT INDICATE 5 MPH.

YES

②
- IGNITION "ON", ENGINE STOPPED.
- TEST LIGHT TO GROUND.
- BACKPROBE ECM TERMINAL "A11".
  NOTE: MAY HAVE TURN DRIVE WHEELS BY HAND WHILE CHECKING.
- LIGHT SHOULD BE "ON". IS IT?

YES

③
- IGNITION "ON", ENGINE RUNNING.
- TRANSAXLE IN DRIVE OR GEAR.
- TEST LIGHT TO GROUND.
- BACKPROBE ECM TERMINAL "A11".

BLINKING

PROBLEM IS INTERMITTENT.
REFER TO "DIAGNOSTIC
AIDS" ON FACING PAGE.

NOT BLINKING

CHECK FOR:
- OPEN IN YEL/GRN WIRE.
- IF NOT OPEN, CHECK VSS GROUND.
- IF OK, REPLACE VSS.

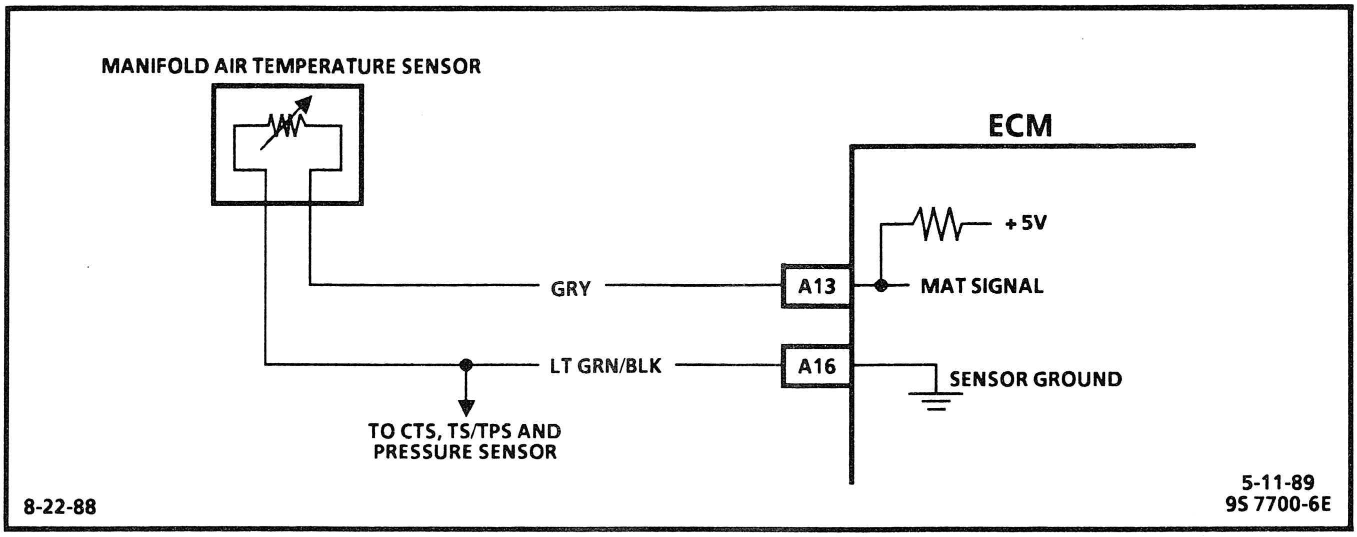
NO (from ②)

SHORT TO GROUND IN
YEL/GRN WIRE OR
FAULTY ECM

NO (from ①)

CHECK FOR
MECHANICAL PROBLEM

CLEAR CODES AND CONFIRM NO "CHECK ENGINE" LIGHT.


MANIFOLD AIR TEMPERATURE SENSOR
ECM
+5V
GRY
A13
MAT SIGNAL
LT GRN/BLK
A16
SENSOR GROUND
TO CTS, TS/TPS AND PRESSURE SENSOR
8-22-88
5-11-89
9S 7700-6E

CODE 25

MANIFOLD AIR TEMPERATURE (MAT) SENSOR CIRCUIT

(HIGH TEMPERATURE INDICATED)

1.0L (VIN 6) "M" CARLINE (TBI)

Circuit Description:

The Manifold Air Temperature (MAT) sensor uses a thermistor to control the signal voltage to the ECM. The ECM applies a voltage (4-6 volts) on GRY wire to the sensor. When manifold air is cold, the sensor (thermistor) resistance is high, therefore, the ECM will see a high signal voltage. As the air warms, the sensor resistance becomes less, and the voltage drops.

Test Description: Numbers below refer to circled numbers on the diagnostic chart.

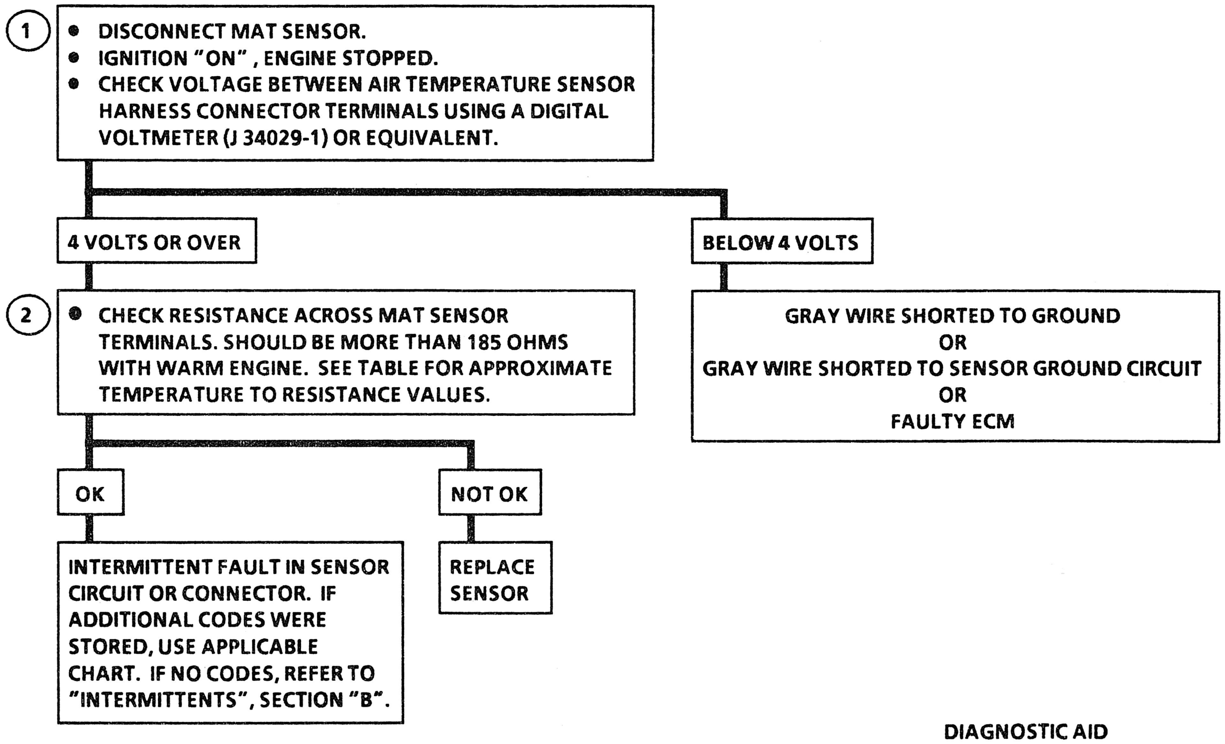
1. Code 25 will set if:
   - Signal voltage indicates an air temperature greater than 136°C (277°F) for 2.7 seconds.
2. If the resistance is less than 100 ohm's, replace the sensor.

Diagnostic Aids:

An intermittent may be caused by a poor connection rubbed through wire insulation or a wire broken inside the insulation. Inspect ECM harness connectors for backed out terminals "A13" or "A16", improper mating, broken locks, improperly formed or damaged terminals, poor terminal to wire connection and damaged harness.

CODE 25

MANIFOLD AIR TEMPERATURE (MAT) SENSOR CIRCUIT
(HIGH TEMPERATURE INDICATED)
1.0L (VIN 6) "M" CARLINE (TBI)



①
- DISCONNECT MAT SENSOR.
- IGNITION "ON", ENGINE STOPPED.
- CHECK VOLTAGE BETWEEN AIR TEMPERATURE SENSOR HARNESS CONNECTOR TERMINALS USING A DIGITAL VOLTMETER (J 34029-1) OR EQUIVALENT.

4 VOLTS OR OVER

BELOW 4 VOLTS

GRAY WIRE SHORTED TO GROUND
OR
GRAY WIRE SHORTED TO SENSOR GROUND CIRCUIT
OR
FAULTY ECM

②
- CHECK RESISTANCE ACROSS MAT SENSOR TERMINALS. SHOULD BE MORE THAN 185 OHMS WITH WARM ENGINE. SEE TABLE FOR APPROXIMATE TEMPERATURE TO RESISTANCE VALUES.

OK

INTERMITTENT FAULT IN SENSOR CIRCUIT OR CONNECTOR. IF ADDITIONAL CODES WERE STORED, USE APPLICABLE CHART. IF NO CODES, REFER TO "INTERMITTENTS", SECTION "B".

NOT OK

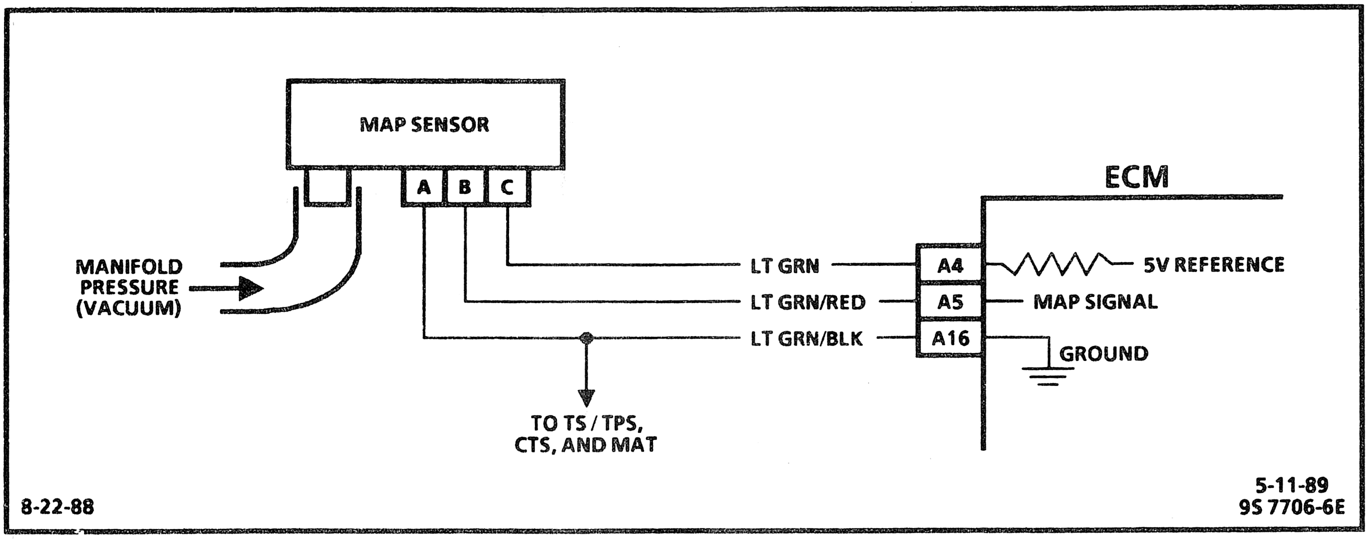
REPLACE SENSOR

DIAGNOSTIC AID

MAT SENSOR
TEMPERATURE TO RESISTANCE VALUES
(APPROXIMATE)

°F	°C	OHMS
210	100	185
160	70	450
100	38	1,800
70	20	3,400
40	4	7,500
20	-7	13,500
0	-18	25,000
-40	-40	100,700

CLEAR CODES AND CONFIRM NO "CHECK ENGINE" LIGHT.


MAP SENSOR
A
B
C
MANIFOLD PRESSURE (VACUUM)
ECM
LT GRN
LT GRN/RED
LT GRN/BLK
A4
A5
A16
5V REFERENCE
MAP SIGNAL
GROUND
TO TS / TPS, CTS, AND MAT
8-22-88
5-11-89
9S 7706-6E

CODE 31

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR CIRCUIT

(SIGNAL VOLTAGE LOW - HIGH VACUUM)

1.0L (VIN 6) "M" CARLINE (TBI)

Circuit Description:

The Manifold Absolute Pressure (MAP) sensor responds to changes in manifold pressure (vacuum). The ECM receives this information as a signal voltage that will vary from about 1 to 1.5 volts at closed throttle idle, to 4 - 4.5 volts at wide open throttle.

If the MAP Sensor fails, the ECM will substitute a fixed MAP value to control fuel delivery.

Test Description: Numbers below refer to circled numbers on the diagnostic chart.

1. This step determines if Code 31 is the result of a hard failure or an intermittent condition.
   A Code 31 will set when:
   - MAP signal voltage is too low (less than 40mmHg) for .5 seconds.
2. Jumpering harness terminals "B" to "C", 5 volts to signal, will determine if the sensor is at fault, or if there is a problem with the ECM or wiring.

Diagnostic Aids:

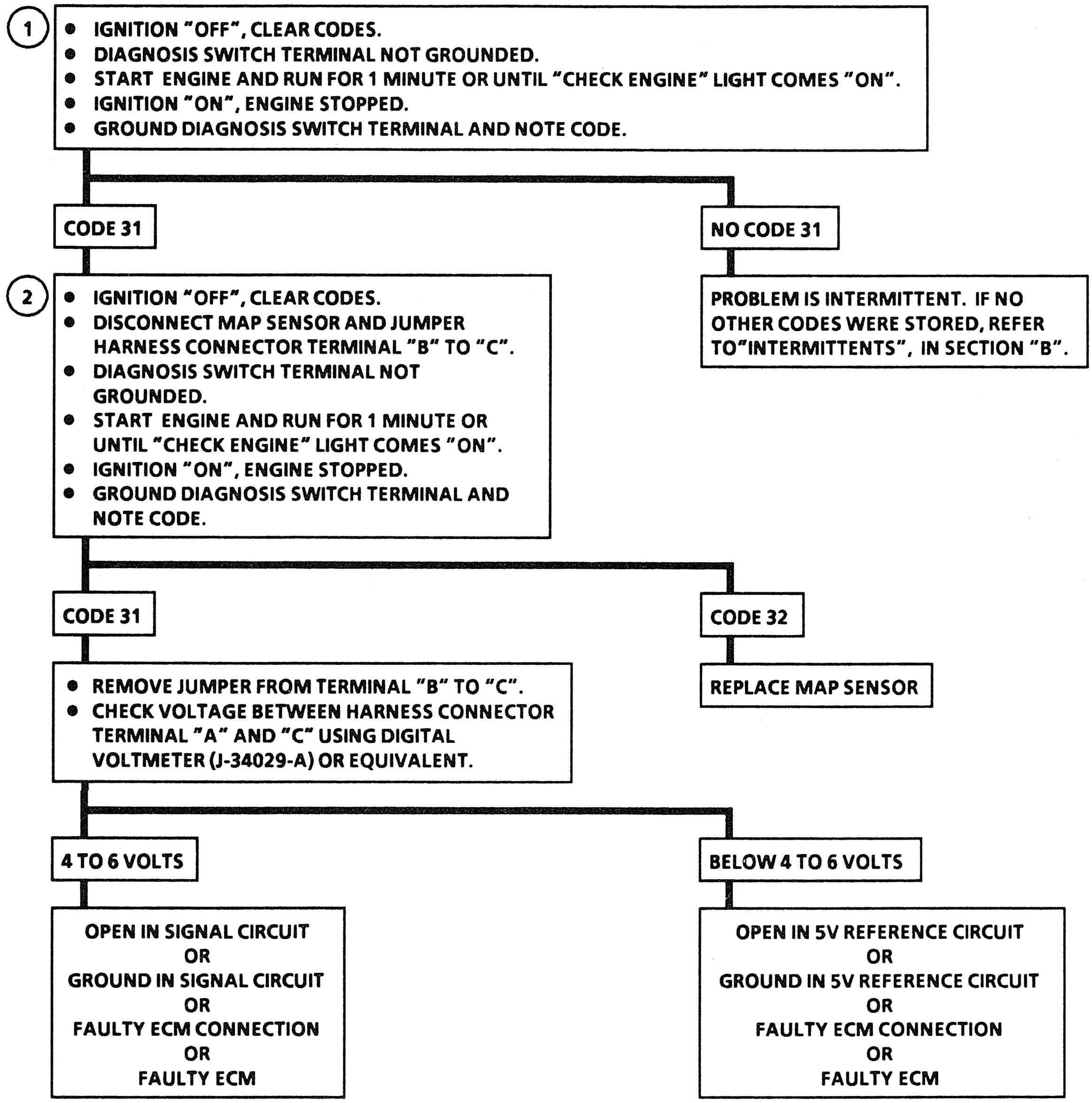
An intermittent may be caused by a poor connection rubbed through wire insulation or a wire broken inside the insulation. Inspect ECM harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal to wire connection and damaged harness.

CODE 31

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR CIRCUIT

(SIGNAL VOLTAGE LOW - HIGH VACUUM)

1.0L (VIN 6) "M" CARLINE (TBI)



①
- IGNITION "OFF", CLEAR CODES.
- DIAGNOSIS SWITCH TERMINAL NOT GROUNDED.
- START ENGINE AND RUN FOR 1 MINUTE OR UNTIL "CHECK ENGINE" LIGHT COMES "ON".
- IGNITION "ON", ENGINE STOPPED.
- GROUND DIAGNOSIS SWITCH TERMINAL AND NOTE CODE.

CODE 31

②
- IGNITION "OFF", CLEAR CODES.
- DISCONNECT MAP SENSOR AND JUMPER HARNESS CONNECTOR TERMINAL "B" TO "C".
- DIAGNOSIS SWITCH TERMINAL NOT GROUNDED.
- START ENGINE AND RUN FOR 1 MINUTE OR UNTIL "CHECK ENGINE" LIGHT COMES "ON".
- IGNITION "ON", ENGINE STOPPED.
- GROUND DIAGNOSIS SWITCH TERMINAL AND NOTE CODE.

CODE 31

- REMOVE JUMPER FROM TERMINAL "B" TO "C".
- CHECK VOLTAGE BETWEEN HARNESS CONNECTOR TERMINAL "A" AND "C" USING DIGITAL VOLTMETER (J-34029-A) OR EQUIVALENT.

4 TO 6 VOLTS

OPEN IN SIGNAL CIRCUIT
OR
GROUND IN SIGNAL CIRCUIT
OR
FAULTY ECM CONNECTION
OR
FAULTY ECM

BELOW 4 TO 6 VOLTS

OPEN IN 5V REFERENCE CIRCUIT
OR
GROUND IN 5V REFERENCE CIRCUIT
OR
FAULTY ECM CONNECTION
OR
FAULTY ECM

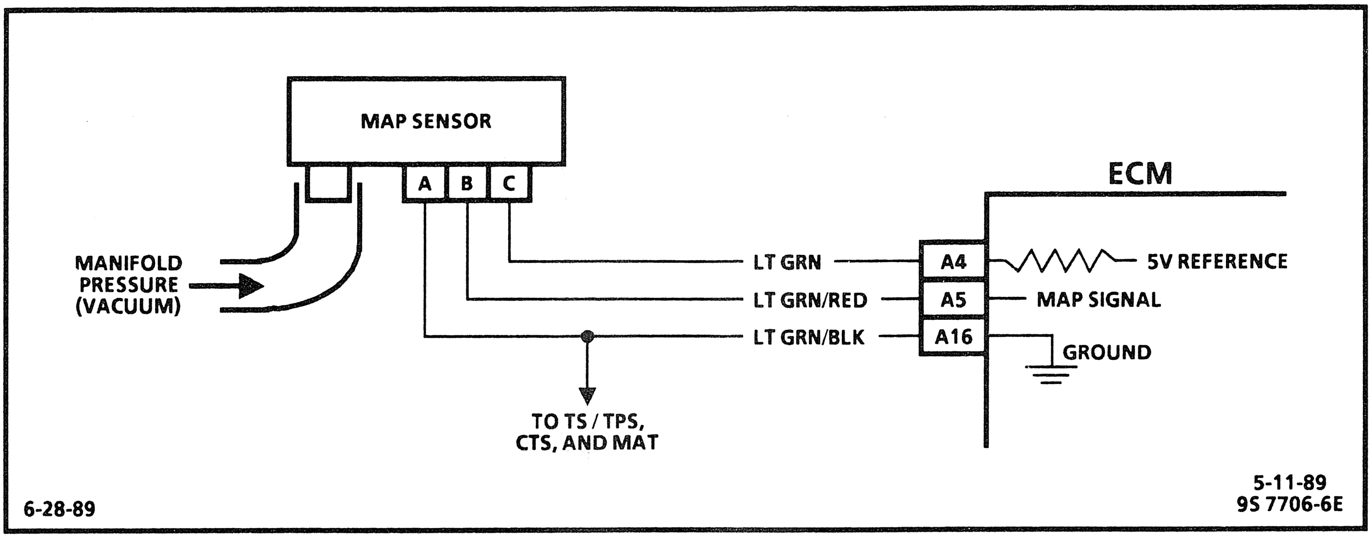
CODE 32

REPLACE MAP SENSOR

NO CODE 31

PROBLEM IS INTERMITTENT. IF NO OTHER CODES WERE STORED, REFER TO"INTERMITTENTS", IN SECTION "B".

CLEAR CODES AND CONFIRM NO "CHECK ENGINE" LIGHT.


MAP SENSOR
A
B
C
MANIFOLD PRESSURE (VACUUM)
ECM
LT GRN
LT GRN/RED
LT GRN/BLK
A4
A5
A16
5V REFERENCE
MAP SIGNAL
GROUND
TO TS / TPS, CTS, AND MAT
6-28-89
5-11-89
9S 7706-6E

CODE 32

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR CIRCUIT
(SIGNAL VOLTAGE HIGH - LOW VACUUM)
1.0L (VIN 6) "M" CARLINE (TBI)

Circuit Description:

The Manifold Absolute Pressure (MAP) sensor responds to changes in manifold pressure (vacuum). The ECM receives this information as a signal voltage that will vary from about 1 to 1.5 volts at closed throttle idle, to 4 - 4.5 volts at wide open throttle.

If the MAP sensor fails, the ECM will substitute a fixed MAP value to control fuel delivery.

Test Description: Numbers below refer to circled numbers on the diagnostic chart.

1. This step will determine if Code 32 is the result of a hard failure or an intermittent condition.

   A Code 32 will set if:

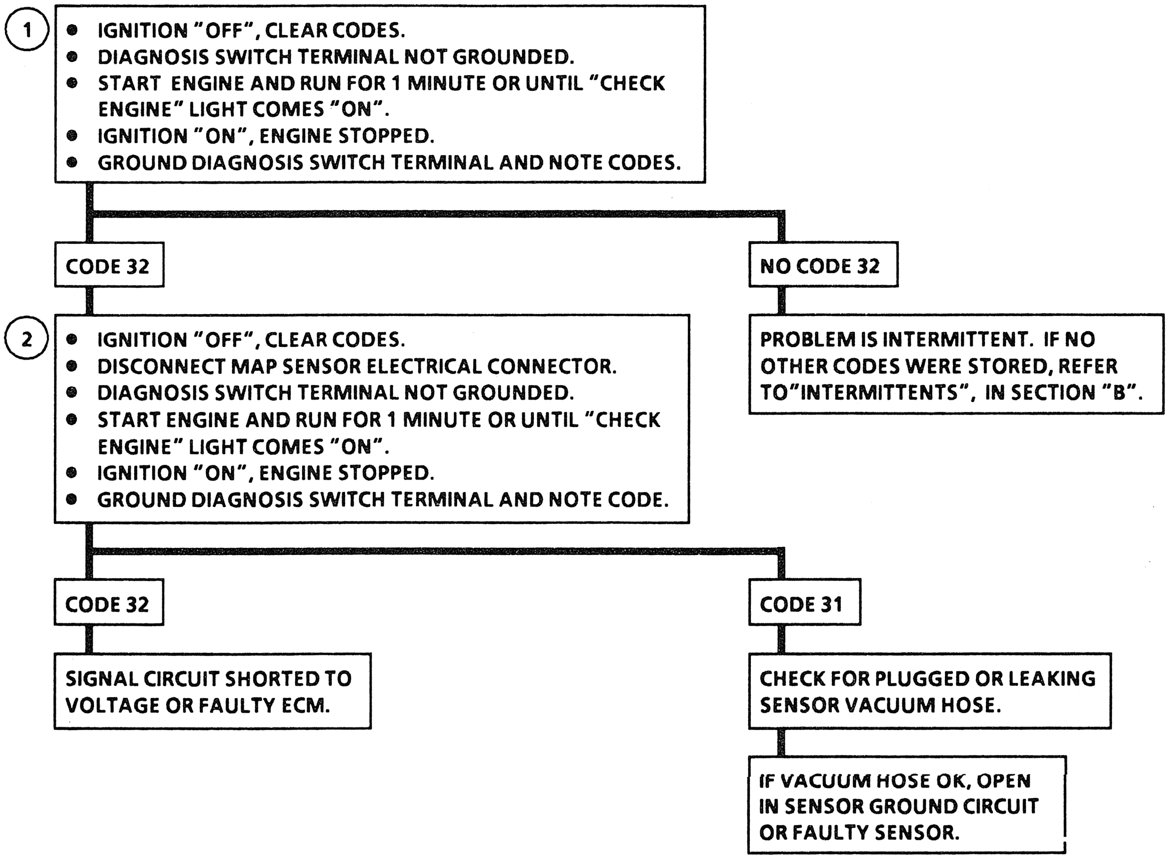
   - MAP signal indicates greater than 940 mm Hg for more than .5 seconds (low vacuum).
2. This step simulates conditions for a Code 31. If the ECM recognizes the change, the ECM and the wire to pressure sensor are OK. If light GRN/ BLK wire is open, there may also be stored Code 25.

Diagnostic Aids:

An intermittent may be caused by a poor connection rubbed through wire insulation or a wire broken inside the insulation. Inspect ECM harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal to wire connection and damaged harness.

CODE 32

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR CIRCUIT
(SIGNAL VOLTAGE HIGH - LOW VACUUM)
1.0L (VIN 6) "M" CARLINE (TBI)



①
- IGNITION "OFF", CLEAR CODES.
- DIAGNOSIS SWITCH TERMINAL NOT GROUNDED.
- START ENGINE AND RUN FOR 1 MINUTE OR UNTIL "CHECK ENGINE" LIGHT COMES "ON".
- IGNITION "ON", ENGINE STOPPED.
- GROUND DIAGNOSIS SWITCH TERMINAL AND NOTE CODES.

CODE 32

NO CODE 32

PROBLEM IS INTERMITTENT. IF NO OTHER CODES WERE STORED, REFER TO"INTERMITTENTS", IN SECTION "B".

②
- IGNITION "OFF", CLEAR CODES.
- DISCONNECT MAP SENSOR ELECTRICAL CONNECTOR.
- DIAGNOSIS SWITCH TERMINAL NOT GROUNDED.
- START ENGINE AND RUN FOR 1 MINUTE OR UNTIL "CHECK ENGINE" LIGHT COMES "ON".
- IGNITION "ON", ENGINE STOPPED.
- GROUND DIAGNOSIS SWITCH TERMINAL AND NOTE CODE.

CODE 32

SIGNAL CIRCUIT SHORTED TO VOLTAGE OR FAULTY ECM.

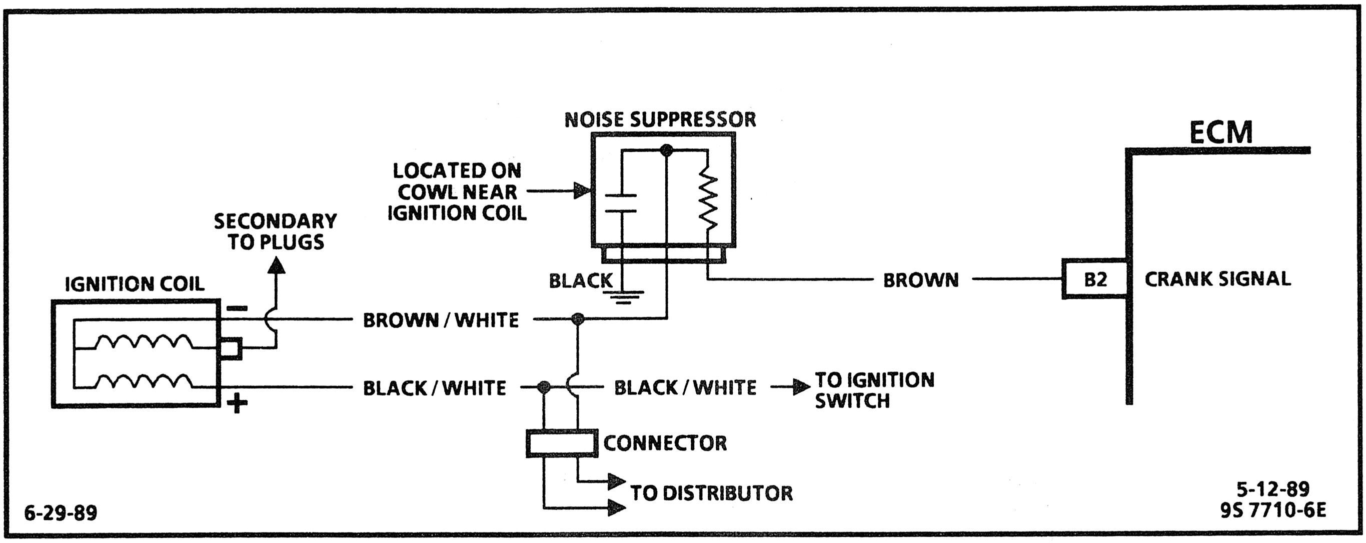
CODE 31

CHECK FOR PLUGGED OR LEAKING SENSOR VACUUM HOSE.

IF VACUUM HOSE OK, OPEN IN SENSOR GROUND CIRCUIT OR FAULTY SENSOR.

CLEAR CODES AND CONFIRM NO "CHECK ENGINE" LIGHT.

5-12-89
9S 7709-6E


NOISE SUPPRESSOR
LOCATED ON COWL NEAR IGNITION COIL
SECONDARY TO PLUGS
IGNITION COIL
BLACK
BROWN
ECM
B2
CRANK SIGNAL
BROWN / WHITE
BLACK / WHITE
BLACK / WHITE
TO IGNITION SWITCH
CONNECTOR
TO DISTRIBUTOR
–
+
6-29-89
5-12-89
9S 7710-6E

CODE 41

IGNITION SIGNAL CIRCUIT

LSI CONVENTIONAL IGNITION SYSTEM (WITH VACUUM ADVANCE)

1.0L (VIN 6) "M" CARLINE (TBI)

Circuit Description:

The ECM receives a signal from the ignition system, which is used as a reference to indicate to the ECM when the ignition coil fires the plugs. The ECM uses this signal to coordinate when to pulse the fuel injector. If the ECM does not receive this signal for 2 seconds when cranking engine, Code 41 will set. The "Check Engine" light will not be "ON" for this code.

Test Description: Numbers below refer to circled numbers on the diagnostic chart.

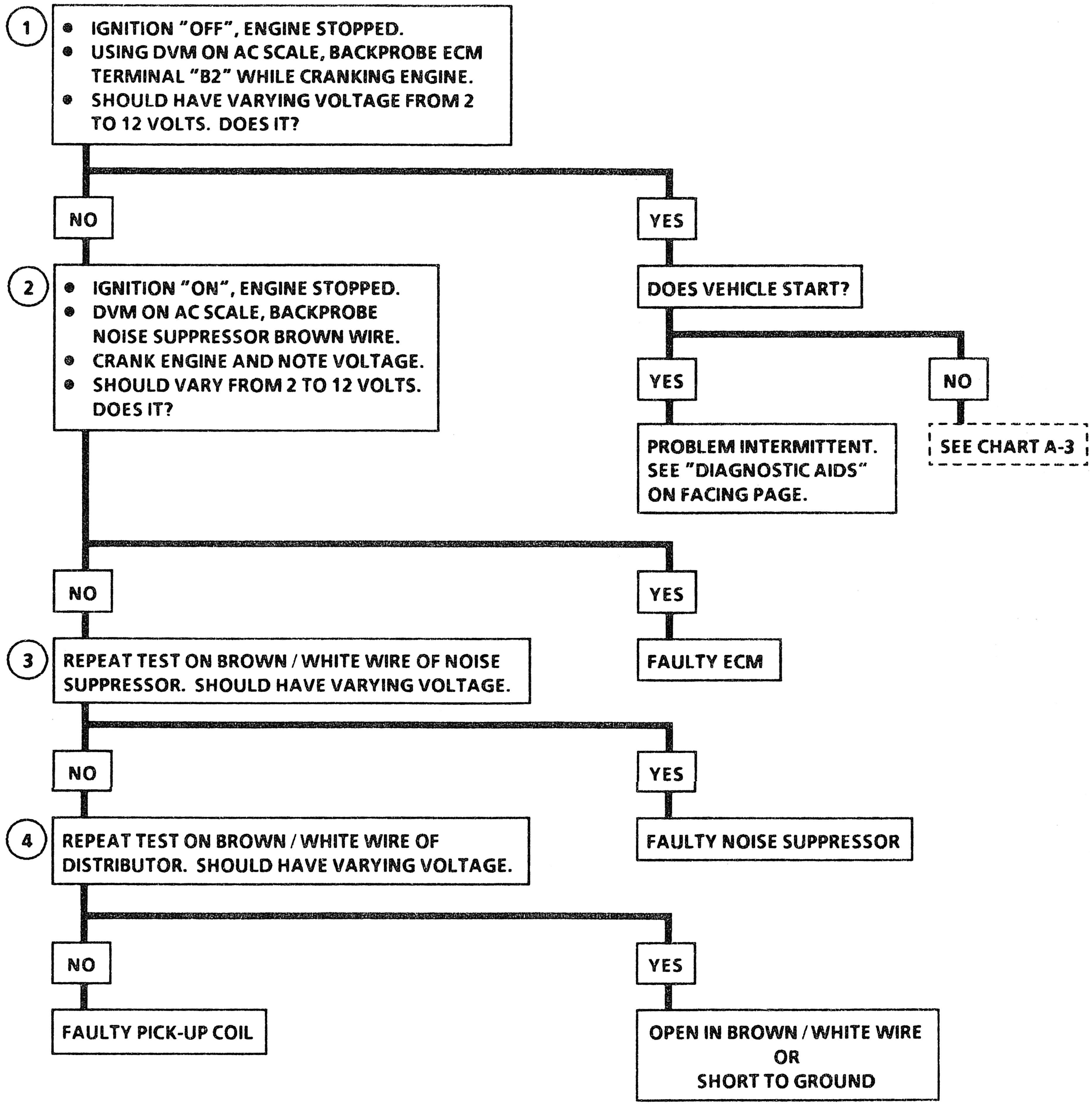
1. The Ignition System sends an AC voltage that varies while cranking.
2. This will check ECM and the noise suppressor.
3. This tests the noise suppressor.
4. This checks the pick-up coil in distributor.

Diagnostic Aids:

An intermittent may be caused by a poor connection rubbed through wire insulation or a wire broken inside the insulation. Inspect ECM harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal to wire connection and damaged harness.

CODE 41

IGNITION SIGNAL CIRCUIT
LSI CONVENTIONAL IGNITION SYSTEM (WITH VACUUM ADVANCE)
1.0L (VIN 6) "M" CARLINE (TBI)



①
- IGNITION "OFF", ENGINE STOPPED.
- USING DVM ON AC SCALE, BACKPROBE ECM TERMINAL "B2" WHILE CRANKING ENGINE.
- SHOULD HAVE VARYING VOLTAGE FROM 2 TO 12 VOLTS. DOES IT?

②
- IGNITION "ON", ENGINE STOPPED.
- DVM ON AC SCALE, BACKPROBE NOISE SUPPRESSOR BROWN WIRE.
- CRANK ENGINE AND NOTE VOLTAGE.
- SHOULD VARY FROM 2 TO 12 VOLTS. DOES IT?

DOES VEHICLE START?

PROBLEM INTERMITTENT. SEE "DIAGNOSTIC AIDS" ON FACING PAGE.

SEE CHART A-3

③ REPEAT TEST ON BROWN / WHITE WIRE OF NOISE SUPPRESSOR. SHOULD HAVE VARYING VOLTAGE.

FAULTY ECM

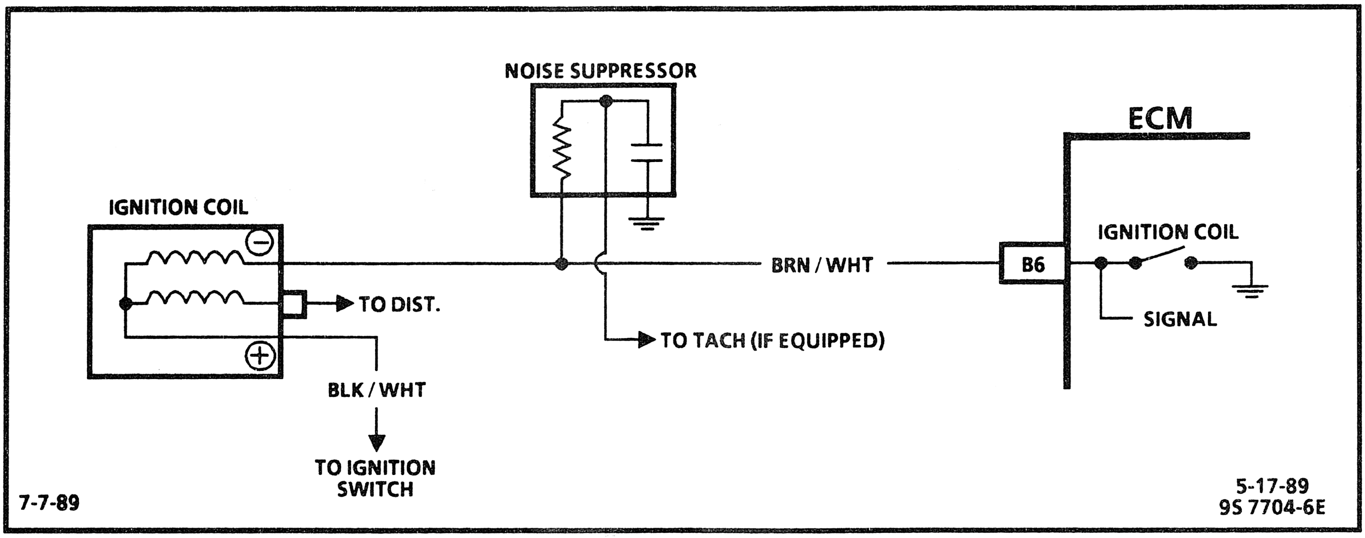
④ REPEAT TEST ON BROWN / WHITE WIRE OF DISTRIBUTOR. SHOULD HAVE VARYING VOLTAGE.

FAULTY NOISE SUPPRESSOR

FAULTY PICK-UP COIL

OPEN IN BROWN / WHITE WIRE
OR
SHORT TO GROUND

CLEAR CODES AND CONFIRM NO "CHECK ENGINE" LIGHT.



CODE 41

IGNITION SIGNAL CIRCUIT
(NO SIGNAL)
ESA IGNITION SYSTEM (WITHOUT VACUUM ADVANCE)
1.0L (VIN 6) "M" CARLINE (TBI)

Circuit Description:

The ECM receives a signal from the ignition coil. The ECM through the use of a driver, allows the coil to provide spark to the distributor. When the driver closes, the 12 volts from the coil is pulled low. When this happens, the ECM senses the low voltage signal. If this signal is not present more than 6 time continuously, while cranking, Code 41 will set. If a Code 42 is present at the same time, repair that code first.

Test Description: Numbers below refer to circled numbers on the diagnostic chart.

1. This will simulate a crank signal to the ECM. The ECM will then ground the ignition coil to create spark.
2. Check voltage supply to coil.
3. Look for the low voltage on ignition coil. The noise suppressor could be shorted to ground.
4. Check to see if ECM in the short to ground in BRN/WHT wire.
5. High resistance in the coil could cause a low voltage.

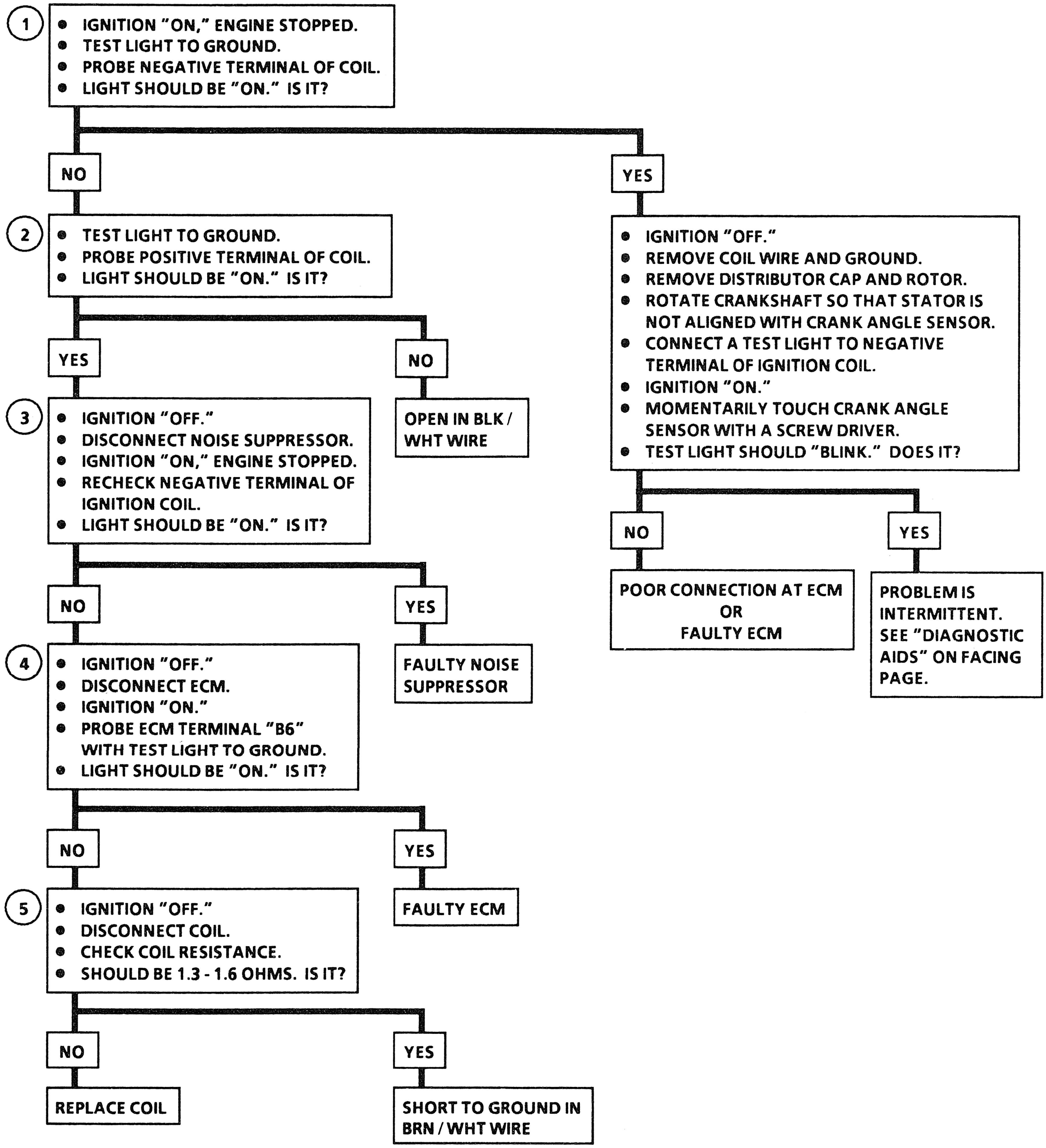
Diagnostic Aids:

An intermittent may be caused by a poor connection rubbed through wire insulation or a wire broken inside the insulation. Inspect ECM harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal to wire connection and damaged harness.

CODE 41

IGNITION SIGNAL CIRCUIT
(NO SIGNAL)
ESA IGNITION SYSTEM (WITHOUT VACUUM ADVANCE)
1.0L (VIN 6) "M" CARLINE (TBI)

NOTE: IF CODE 42 IS STORED, GO TO THAT CODE FIRST.



1
- IGNITION "ON," ENGINE STOPPED.
- TEST LIGHT TO GROUND.
- PROBE NEGATIVE TERMINAL OF COIL.
- LIGHT SHOULD BE "ON." IS IT?

2
- TEST LIGHT TO GROUND.
- PROBE POSITIVE TERMINAL OF COIL.
- LIGHT SHOULD BE "ON." IS IT?

OPEN IN BLK / WHT WIRE

3
- IGNITION "OFF."
- DISCONNECT NOISE SUPPRESSOR.
- IGNITION "ON," ENGINE STOPPED.
- RECHECK NEGATIVE TERMINAL OF IGNITION COIL.
- LIGHT SHOULD BE "ON." IS IT?

FAULTY NOISE SUPPRESSOR

4
- IGNITION "OFF."
- DISCONNECT ECM.
- IGNITION "ON."
- PROBE ECM TERMINAL "B6" WITH TEST LIGHT TO GROUND.
- LIGHT SHOULD BE "ON." IS IT?

FAULTY ECM

5
- IGNITION "OFF."
- DISCONNECT COIL.
- CHECK COIL RESISTANCE.
- SHOULD BE 1.3 - 1.6 OHMS. IS IT?

REPLACE COIL

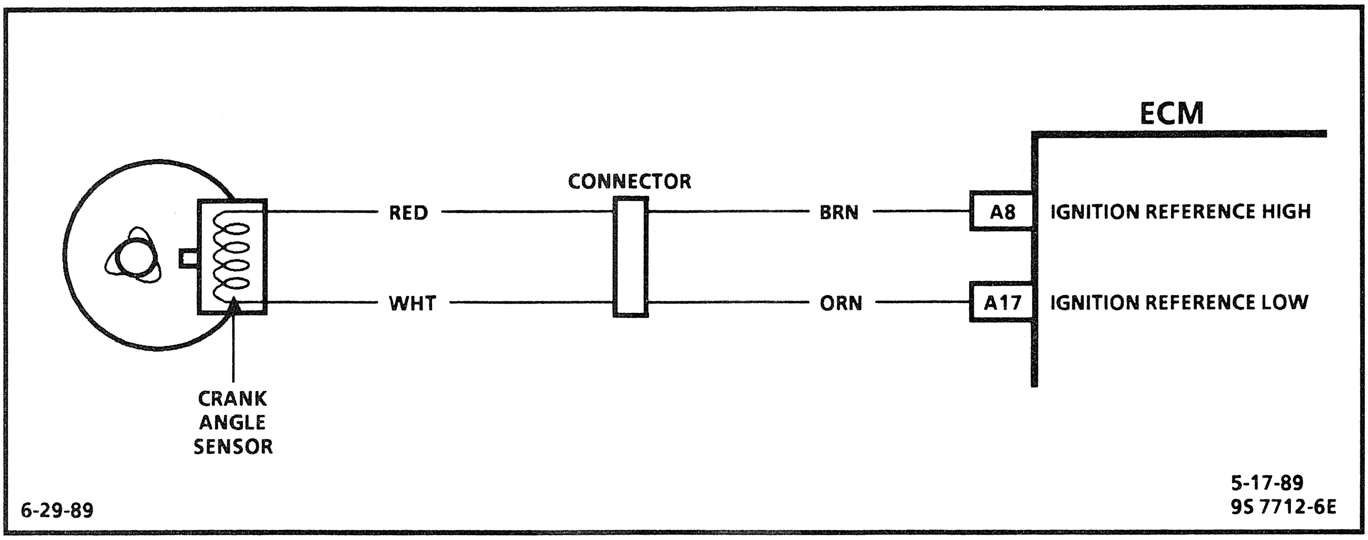
SHORT TO GROUND IN BRN / WHT WIRE

- IGNITION "OFF."
- REMOVE COIL WIRE AND GROUND.
- REMOVE DISTRIBUTOR CAP AND ROTOR.
- ROTATE CRANKSHAFT SO THAT STATOR IS NOT ALIGNED WITH CRANK ANGLE SENSOR.
- CONNECT A TEST LIGHT TO NEGATIVE TERMINAL OF IGNITION COIL.
- IGNITION "ON."
- MOMENTARILY TOUCH CRANK ANGLE SENSOR WITH A SCREW DRIVER.
- TEST LIGHT SHOULD "BLINK." DOES IT?

POOR CONNECTION AT ECM OR FAULTY ECM

PROBLEM IS INTERMITTENT. SEE "DIAGNOSTIC AIDS" ON FACING PAGE.

CLEAR CODES AND CONFIRM NO "CHECK ENGINE" LIGHT.



CODE 42

CRANK ANGLE SENSOR CIRCUIT

(NO SIGNAL FOR 2 SECONDS)

ESA IGNITION SYSTEM (WITHOUT VACUUM ADVANCE)

1.0L (VIN 6) "M" CARLINE (TBI)

Circuit Description:

The ECM supplies 12 volts to the crank angle sensor at terminal "A8". As the stator inside the distributor passes the crank angle sensor, the 12 volts is pulled low. The ECM uses this signal (at terminal A17) in determining when to fire the the coil and the fuel injector. If this signal is not present during cranking, Code 42 will set. A Code 41 may also set.

Test Description: Numbers below refer to circled numbers on the diagnostic chart.

1. B+ is supplied by the ECM to the distributor module.
2. A short to voltage in BRN or TAN wires.
3. Checking the ECM for voltage on Terminals "A8" or "A17".
4. Looking for short to ground.
5. Improper air gap could be the cause of Code 42.

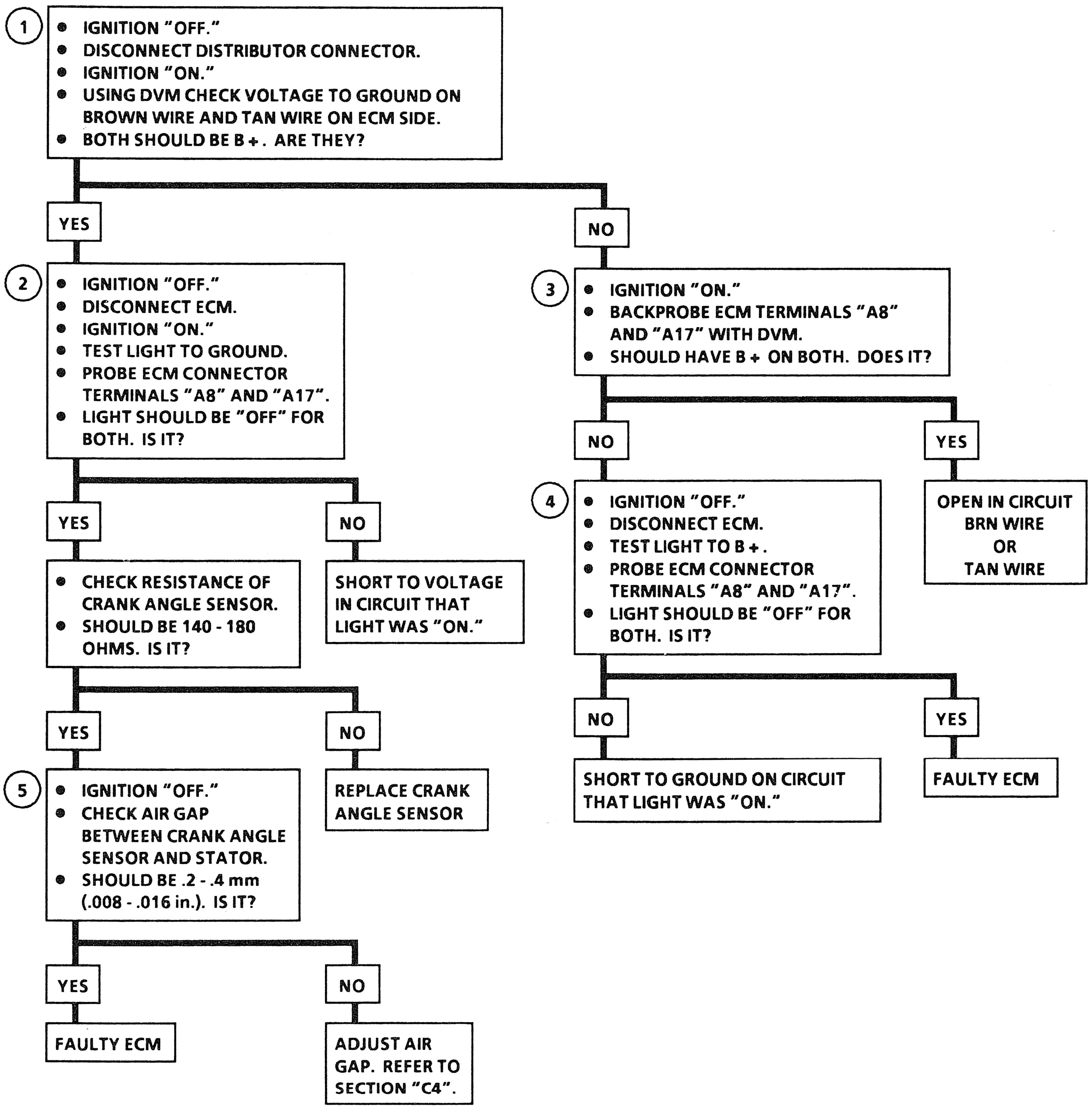
Diagnostic Aids:

An intermittent may be caused by a poor connection rubbed through wire insulation or a wire broken inside the insulation. Inspect ECM harness connectors for backed out terminals "A8" or "A17", improper mating, broken locks, improperly formed or damaged terminals, poor terminal to wire connection and damaged harness.

CODE 42

CRANK ANGLE SENSOR CIRCUIT

(NO SIGNAL FOR 2 SECONDS)
ESA IGNITION SYSTEM (WITHOUT VACUUM ADVANCE)
1.0L (VIN 6) "M" CARLINE (TBI)



①
- IGNITION "OFF."
- DISCONNECT DISTRIBUTOR CONNECTOR.
- IGNITION "ON."
- USING DVM CHECK VOLTAGE TO GROUND ON BROWN WIRE AND TAN WIRE ON ECM SIDE.
- BOTH SHOULD BE B+. ARE THEY?

YES → ②
- IGNITION "OFF."
- DISCONNECT ECM.
- IGNITION "ON."
- TEST LIGHT TO GROUND.
- PROBE ECM CONNECTOR TERMINALS "A8" AND "A17".
- LIGHT SHOULD BE "OFF" FOR BOTH. IS IT?

YES →
- CHECK RESISTANCE OF CRANK ANGLE SENSOR.
- SHOULD BE 140 - 180 OHMS. IS IT?

YES → ⑤
- IGNITION "OFF."
- CHECK AIR GAP BETWEEN CRANK ANGLE SENSOR AND STATOR.
- SHOULD BE .2 - .4 mm (.008 - .016 in.). IS IT?

YES → FAULTY ECM

NO → ADJUST AIR GAP. REFER TO SECTION "C4".

NO → REPLACE CRANK ANGLE SENSOR

NO → SHORT TO VOLTAGE IN CIRCUIT THAT LIGHT WAS "ON."

NO → ③
- IGNITION "ON."
- BACKPROBE ECM TERMINALS "A8" AND "A17" WITH DVM.
- SHOULD HAVE B+ ON BOTH. DOES IT?

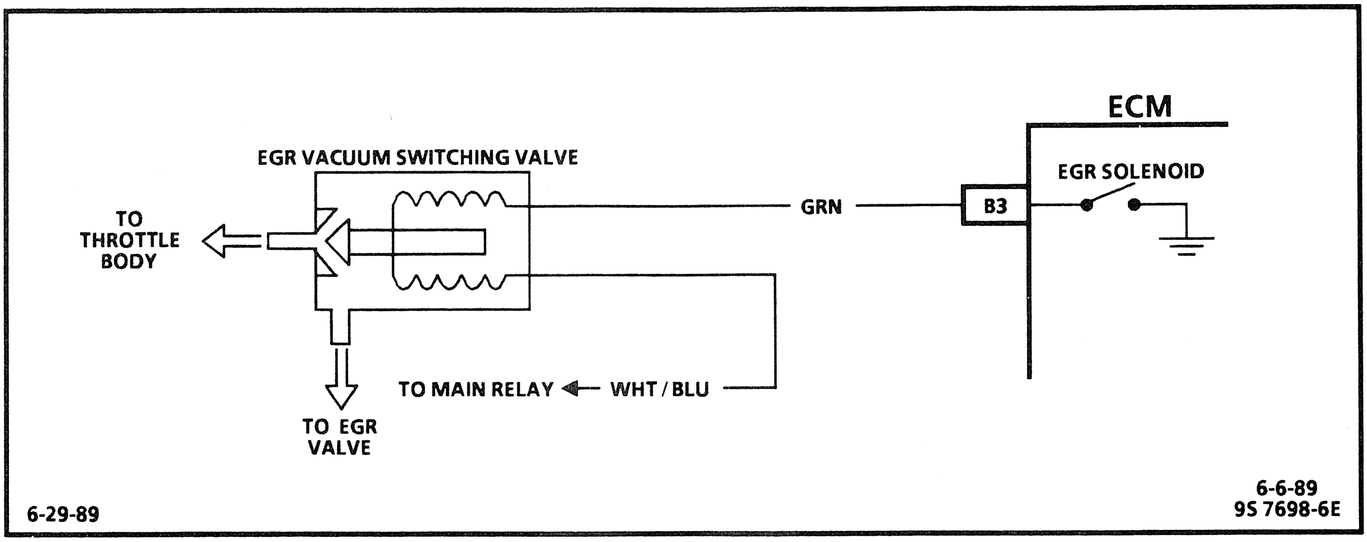
NO → ④
- IGNITION "OFF."
- DISCONNECT ECM.
- TEST LIGHT TO B+.
- PROBE ECM CONNECTOR TERMINALS "A8" AND "A17".
- LIGHT SHOULD BE "OFF" FOR BOTH. IS IT?

NO → SHORT TO GROUND ON CIRCUIT THAT LIGHT WAS "ON."

YES → FAULTY ECM

YES → OPEN IN CIRCUIT BRN WIRE OR TAN WIRE

CLEAR CODES AND CONFIRM NO "CHECK ENGINE" LIGHT.


ECM
EGR VACUUM SWITCHING VALVE
EGR SOLENOID
TO THROTTLE BODY
GRN
B3
TO MAIN RELAY
WHT / BLU
TO EGR VALVE
6-29-89
6-6-89
9S 7698-6E

CODE 51

EXHAUST GAS RECIRCULATION (EGR) CIRCUIT

(CALIFORNIA EMISSIONS SYSTEMS ONLY)

1.0L (VIN 6) "M" CARLINE (TBI)

Circuit Description:

The EGR Vacuum Switching Valve (VSV) solenoid is ECM controlled. Battery voltage is applied to the VSV solenoid from the main relay. When the driver in the ECM closes, the VSV solenoid is activated.

Test Description: Numbers below refer to circled numbers on the diagnostic chart.

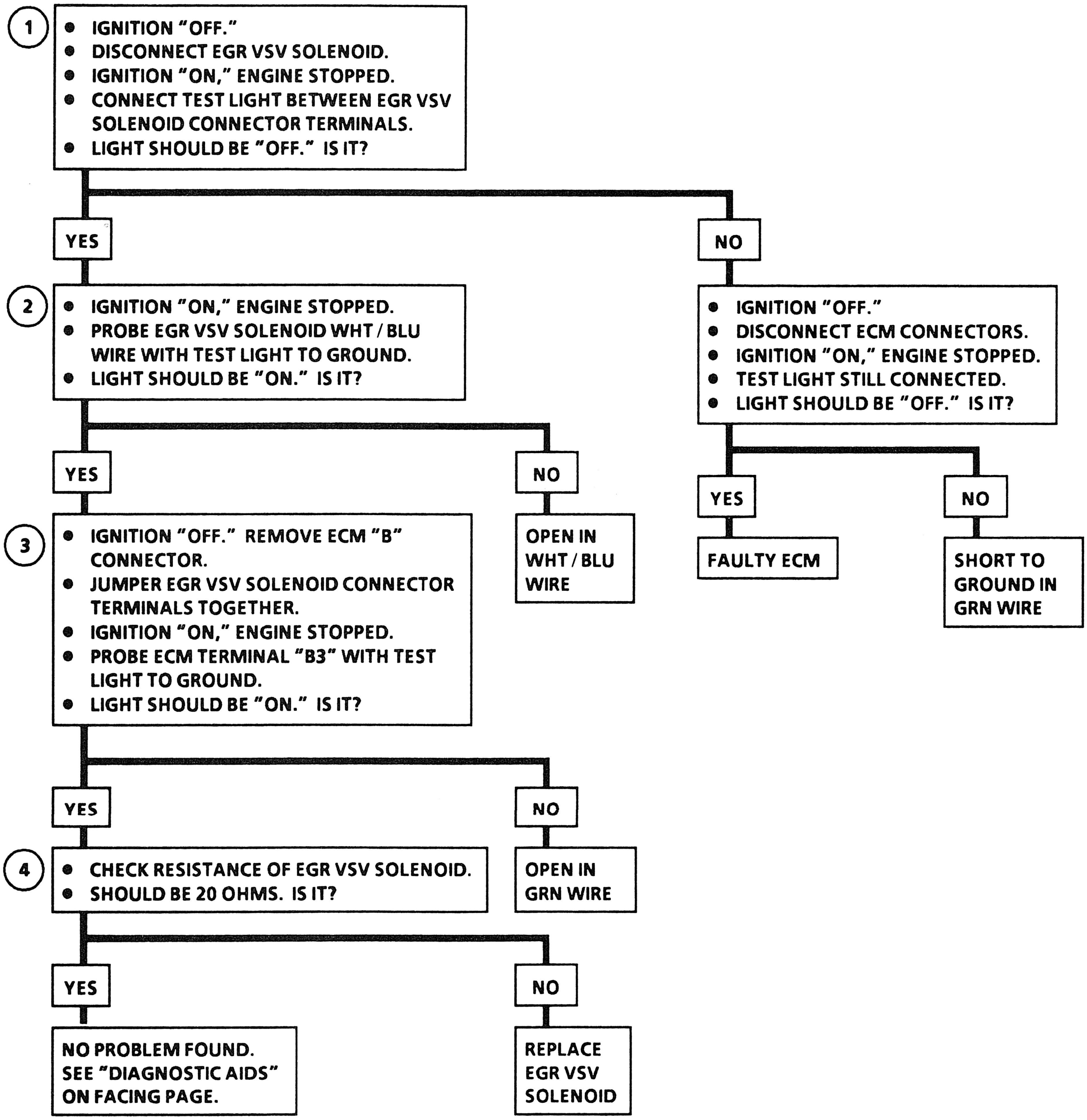
1. This will check the circuit for a short to ground.
2. Check for voltage from main relay.
3. Checks the circuit for fault of code or a faulty ECM.
4. A high resistance in solenoid coil could cause a Code 51.

Diagnostic Aids:

A poor or loose connection at the ECM could cause an Intermittent. This could cause a code to be set falsely.

CODE 51

EXHAUST GAS RECIRCULATION (EGR) CIRCUIT
(CALIFORNIA EMISSIONS SYSTEMS ONLY)
1.0L (VIN 6) "M" CARLINE (TBI)


1
• IGNITION "OFF."
• DISCONNECT EGR VSV SOLENOID.
• IGNITION "ON," ENGINE STOPPED.
• CONNECT TEST LIGHT BETWEEN EGR VSV SOLENOID CONNECTOR TERMINALS.
• LIGHT SHOULD BE "OFF." IS IT?
YES
NO
2
• IGNITION "ON," ENGINE STOPPED.
• PROBE EGR VSV SOLENOID WHT / BLU WIRE WITH TEST LIGHT TO GROUND.
• LIGHT SHOULD BE "ON." IS IT?
• IGNITION "OFF."
• DISCONNECT ECM CONNECTORS.
• IGNITION "ON," ENGINE STOPPED.
• TEST LIGHT STILL CONNECTED.
• LIGHT SHOULD BE "OFF." IS IT?
YES
NO
YES
NO
3
• IGNITION "OFF." REMOVE ECM "B" CONNECTOR.
• JUMPER EGR VSV SOLENOID CONNECTOR TERMINALS TOGETHER.
• IGNITION "ON," ENGINE STOPPED.
• PROBE ECM TERMINAL "B3" WITH TEST LIGHT TO GROUND.
• LIGHT SHOULD BE "ON." IS IT?
OPEN IN WHT / BLU WIRE
FAULTY ECM
SHORT TO GROUND IN GRN WIRE
YES
NO
4
• CHECK RESISTANCE OF EGR VSV SOLENOID.
• SHOULD BE 20 OHMS. IS IT?
OPEN IN GRN WIRE
YES
NO
NO PROBLEM FOUND. SEE "DIAGNOSTIC AIDS" ON FACING PAGE.
REPLACE EGR VSV SOLENOID

CLEAR CODES AND CONFIRM NO "CHECK ENGINE" LIGHT.

SECTION B

SYMPTOMS

CONTENTS

Before Starting .... Page B-1
Intermittents .... Page B-1
Backfire .... Page B-1
Hard Starting .... Page B-2
Hesitation, Sag, Stumble .... Page B-2
Surges and/or Chuggle .... Page B-2
Lack of Power, Sluggish, or Spongy .... Page B-3
Detonation / Spark Knock .... Page B-3
Rough, Unstable, or Incorrect Idle, Stalling .... Page B-3
Poor Fuel Economy .... Page B-4
Cuts Out, Misses .... Page B-4
Excessive Exhaust Emissions or Odors .... Page B-4

BEFORE STARTING

Before using this section you should have performed the DIAGNOSTIC CIRCUIT CHECK and found out that:

1. The ECM and "Check Engine" light are operating.
2. There are no trouble codes.

Verify the customer complaint, and locate the correct SYMPTOM below. Check the items indicated under that symptom.

If the ENGINE CRANKS BUT WILL NOT RUN, see CHART A-3.

Several of the symptom procedures below call for a Careful Visual Check. This check should include:

- ECM grounds for being clean and tight.
- Vacuum hoses for splits, kinks, and proper connections, as shown on Emission Control Information label.
- Air leaks at throttle body mounting and intake manifold.
- Wiring for proper connections, pinches, and cuts.

The importance of this step cannot be stressed too strongly - it can lead to correcting a problem without further checks and can save valuable time.

INTERMITTENTS

Problem may or may not turn "ON" the "Check Engine" light, or store a code.
Most intermittent problems are caused by faulty electrical connections or damaged wiring.

- Perform a visual check of suspected circuits.
  - Poor or loose connection of connectors.
  - Misrouted wiring.
  - Inspect any loose connector for corrosion or terminal loose in cavity.
  - Damaged or poorly formed terminals.
  - Poor terminal to wire connection, broken wire strands, insulation pinched in terminal.

BACKFIRE

Definition: Fuel ignites in intake manifold, or in exhaust system, making a loud popping noise.

- **CHECK:**
  - Spark plugs.
  - Output voltage of ignition coils, using a spark tester J 26793 (ST-125), or equivalent.
  - Intermittent in ignition system. See Section "C4".
  - Compression, look for valve train problem, valve timing etc.
  - Intake manifold gasket leak, TBI gasket to manifold leak.
  - A/C VSV not functioning properly. Refer to Section "C7".

HARD STARTING

Definition: Engine cranks okay, but does not start for a long time. Will eventually start, or stalls after starting.

- Perform a careful visual check as described at the start of this section.
- Verify driver is following correct procedure for starting engine.
- **CHECK:**
  - EGR stuck open.
  - PCV valve stuck open or disconnected.
  - Blown ignition fuse.
  - Low fuel in tank.
  - Faulty fuel pump.
  - Low fuel pressure.
  - Air valve faulty.
  - Intermittent crank signal to ECM. See Section "C4".
  - Faulty MAT sensor signal. See Section "C1".
  - Faulty coolant temperature sensor signal. See Section "C2".
  - Faulty pressure sensor signal. See Section "C1".
  - Faulty ECM. See Section "C1".
  - Faulty spark plug wire.
  - Faulty or loose distributor cap, crack in cap.
  - Damaged distributor rotor.
  - Faulty or fowled spark plugs.
  - Dirty or plugged fuel filter, or fuel lines.
  - Improper ignition timing.
  - Misadjusted pick-up coil in distributor.
  - Faulty Electronic Spark Advance (ESA).
  - Faulty ignition coil.
  - Faulty noise suppressor.
  - Fuel pump intermittently not working.
  - Poor torque or low torque of spark plugs.
  - Low compression.

HESITATION, SAG, STUMBLE

Definition: Momentary lack of response as the accelerator is pushed down. Can occur at all car speeds. Usually most severe when first trying to make the car move, as from a stop sign. May cause engine stall if severe enough.

- Make a careful visual check as described at the beginning of Section "B".
- **CHECK:**
  - Air cleaner assembly for clogged filter, restricted air inlet tube, etc.
  - Engine timing.
  - Distributor cap for damage or being loose.
  - Spark plug wire for proper resistance, cracked boot or damage to cable.
  - Faulty spark plug, improper spark plug gap.
  - Restricted fuel filter, or fuel lines.
  - Poor connection at injector.
  - EGR valve malfunctioning.
  - Engine overheating.
  - Throttle Switch (M/T) or Throttle Position Sensor (A/T) misadjusted, sticking.
  - Electronic Spark Advance (ESA) for proper operation. Refer to Section "C4".
  - Faulty ECM. See Section "C1".

SURGES AND/OR CHUGGLE

Definition: Engine power variation under steady throttle or cruise. Feels like the car speeds up and slows down with no change in the accelerator pedal.

- Verify the problem and the customer understand the transaxle operation.
- Check if problem exists with A/C is "ON" only.
- Perform a careful visual check as described at the beginning of Section "B".
- **CHECK:**
  - Fuel pressure for varying.
  - Engine ignition timing
  - Electronic Spark Advance (ESA) for proper operation.
  - Leaky or loose spark plug wire(s).
  - Fouled, burnt electrode, improperly gapped spark plugs.
  - Electronic fuel injection system operation. See Section "C2".
  - Restricted fuel line, clogged, kinked, damaged, etc.
  - Ignition system operation. See Section "C4".
  - EGR valve operation. See Section "C7".
  - Faulty pressure sensor signal.

LACK OF POWER, SLUGGISH, OR SPONGY

Definition: Engine delivers less than expected power. Little or no increase in speed when accelerator pedal is pushed down part way.

- Compare customer's car to similar unit. Verify the problem actually exists.
- Perform careful visual check as described at the start of Section "B".
- Remove air cleaner assembly and check for filter being clogged, or air inlet tube being restricted.
- **CHECK:**
  - Visual check of vacuum hoses for damage or loosely connected.
  - Engine ignition timing.
  - Loose, damaged, or defective spark plug wire(s).
  - Fouled spark plugs, mechanical problems, oil consumption, etc.
  - Engine overheating.
  - Worn distributor terminal.
  - Electronic spark advance system for proper operation. See Section "C4".
  - Vacuum leak at intake manifold.
  - Slipping clutch (if equipped).
  - Fuel pump pressure. See Section "C2".
  - EFI system for proper operation. See Section "C2".
  - Low cylinder compression.
  - EGR valve operation. See Section "C7".
  - Brake system, dragging brakes, stuck brakes, etc.
  - Accelerator cable play wrong.
  - Poor performance of manifold air temperature sensor signal.
  - Poor performance of coolant temperature sensor signal.
  - Poor performance of Throttle Switch (M/T) or Throttle Position Sensor (A/T) signal.
  - Faulty ECM. See Section "C1".

DETONATION / SPARK KNOCK

Definition: Engine makes sharp metallic knocks that change with throttle position. Sounds like popcorn popping.

- Check for obvious problem such as:
  - Engine overheating due to loose belts or restricted air flow through the radiator.
  - Restricted coolant flow through radiator or engine.
- **CHECK:**
  - Ignition timing.
  - Proper spark plug(s) and gap.
  - Poor spark plug wire connections.
  - EFI system. See Section "C2".
  - EGR valve operation. See Section "C7".
  - Fuel quality.
  - Excessive oil in combustion chamber.
  - PCV valve operation. See Section "C13".
  - Visual check for intake gasket leaks.
  - ESA system. See Section "C4"
  - Restricted Exhaust System.
  - Clean engine combustion chambers with top engine cleaner.
  - Follow instructions on the car.

ROUGH, UNSTABLE, OR INCORRECT IDLE, STALLING

Definition: Engine idle unevenly, or RPM may vary (called hunting). If bad enough car may shake. Either condition may cause the car to stall if severe enough, engine idle speed incorrect.

- Perform a careful visual check as described at the start of Section "B".
- Check accelerator cable for proper operation.
- Visually check all vacuum hose connections.
- **CHECK:**
  - Worn distributor cap terminals.
  - Ignition timing.
  - Defective or damaged distributor cap.
  - ESA system. See Section "C4".
  - Air cleaner assembly for clogged filter or restricted air inlet tubes.
  - Intake for leaks.
  - Faulty spark plugs or wrong spark plugs.
  - EFI system. See Section "C2".
  - Engine overheating.
  - Low compression.
  - EGR valve operation. See Section "C7".
  - PCV valve operation. See Section "C13".

POOR FUEL ECONOMY

Definition: Fuel economy, as measured by an actual road test, is noticeably lower than expected. Also, economy is noticeably lower than it was on this car at one time, as previously shown by an actual road test.

- Visually check vacuum lines for cracks, loose connections, or damage.
- Check fuel delivery system of obvious leaks.
- Verify the actual fuel mileage.
- **CHECK:**
  - Air cleaner filter to be clogged, or air inlet tube blocked.
  - Ignition timing.
  - Wrong spark plugs, or worn, damaged spark plugs.
  - Poor fuel quality.
  - Restricted exhaust. See CHART B-1 of this section.
  - Transaxle operation, i.e.; slipping, not shifting, wrong shift points (M/T) clutch slipping.
  - Brakes not fully releasing.
  - Wrong or faulty thermostat.
  - Wrong tire size or improper tire pressure.
  - EGR valve operation. See Section "C7".
  - EFI system. See Section "C2".
  - PCV valve operation. See Section "C13".
  - ESA system. See Section "C4".
  - High idle.
  - Faulty Throttle Switch (M/T) or Throttle Position Sensor (A/T) signal.
  - Faulty MAT sensor signal.
  - Faulty coolant temperature sensor signal.
  - Faulty ECM.

CUTS OUT, MISSES

Definition: Steady pulsation or jerking that follows engine speed, usually more pronounced as engine load increases. Not normally felt above 1500 RPM or 30 mph (48 km/H). The exhaust has a steady spitting sound at idle or low speed.

- Perform carefuly visual check as described at the start of Section "B".
- Check for misfiring cylinder, spark plugs, spark plug wires, coil connection, etc.
- Perform compression check to verify if problem is mechanical and not electrical.
- Check EGR valve for not properly scaling, stuck partly open.
- Check ignition timing.
- Check CAM timing.

EXCESSIVE EXHAUST EMISSIONS OR ODORS

Definition: Vehicle fails an emission test or vehicle has excessive "rotten egg" smell. (Excessive odors do not necessarily indicate excessive emissions).

Perform careful visual and physical check as described at the beginning of Section "B".

Perform "Diagnostic Circuit Check."

- **CHECK**
  - EGR valve not opening. Use CHART C-7.
  - Vacuum leaks
  - Faulty coolant system and/or coolant fan operation. Use CHART C-12.
  - Remove carbon with top engine cleaner. Follow instructions on can.
- If the system is running RICH (block learn less than 118), refer to "Diagnostic Aids" on facing page of Code 45.
- If the system is running LEAN (block learn greater than 138), refer to "Diagnostic Aids" on facing page of Code 44.
- If emission test indicates excessive NO_X, check for items which cause car to run lean or too hot.
- If emission test indicates excessive HC and CO or exhaust has excessive odors, check for items which cause car to run RICH.
  - Incorrect fuel pressure. Use CHART A-7.
  - Fuel loading of evaporative vapor canister. Use CHART C-3.
  - PCV valve plugging, sticking, or blocked PCV hose. Check for fuel in crankcase.
  - Catalytic converter lead contamination (Look for removal of fuel filler neck restrictor.)
  - Improper fuel cap installation
  - Faulty spark plugs, plug wires, or ignition components. See Section "6D".

SECTION C

COMPONENT SYSTEMS

Section "C" provides information on the following:

- General description of components and sub-systems.
- On-vehicle service.
- Part names and group numbers.
- Diagnostic charts. These include a functional check of the system as well as diagnosis of any problem found in the functional check.

For locations of components, wiring diagrams, and ECM Terminal End View, refer to the front of the "A" Section.

Refer to the following sections for the appropriate sub-system information:

- C1 Electronic Control Module (ECM) and Sensors .... **Page C1-1**
- C2 Fuel Metering System .... **Page C2-1**
- C3 Evaporative Emission Control System (EECS) .... **Page C3-1**
- C4 Ignition System .... **Page C4-1**
- C7 Exhaust Gas Recirculation (EGR) System .... **Page C7-1**
- C8 Manual Transaxle (M/T) Shift Light .... **Page C8-1**
- C13 Positive Crankcase Ventilation (PCV) System .... **Page C13-1**

DIAGNOSTIC CHARTS

The following diagnostic charts can be found at the end of some of the sections.

- CHART C-8 Manual Transaxle (M/T) Shift Light Check .... **Page C8-2**

SECTION C1

ELECTRONIC CONTROL MODULE (ECM) AND SENSORS

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GENERAL DESCRIPTION

ELECTRONIC CONTROL MODULE (ECM)

The ECM is installed to the underside of the instrument panel on the driver's side.

The ECM is a precision unit consisting of a one chip microcomputer, A/D (Analog/Digital) converter, I/O (Input/Output) unit, ROM (Read Only Memory) and RAM (Random Access Memory). It is an essential part of the electronic control system, for its functions include not only such major functions as to control the fuel injector, ISC solenoid valve, fuel pump relay, etc. but also a self-diagnosis function and a fail-safe function as described in the following section.

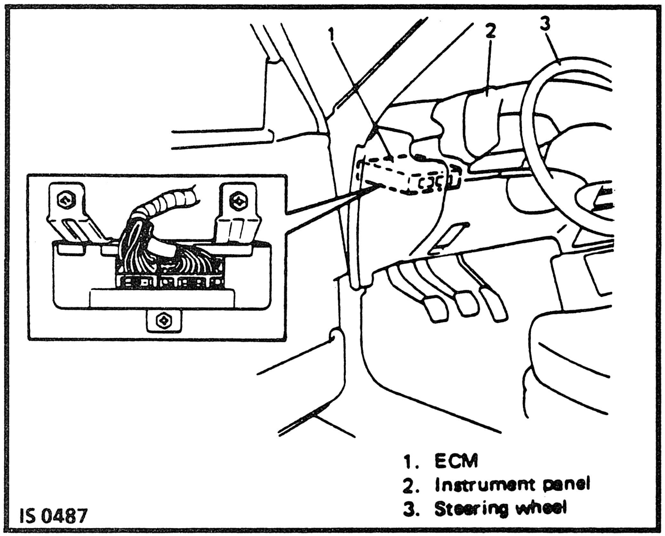


Figure C1-1 - ECM and Location

SELF-DIAGNOSIS FUNCTION

The ECM diagnoses troubles which may occur in the system when the ignition switch is "ON" and the engine is running. It indicates the result by turning "ON" or flashing "Check Engine" light when a fault occurs in any of the following systems:

- Oxygen Sensor
- Coolant Temperature Sensor
- Throttle Switch (M/T model) or Throttle Position Sensor (A/T model)
- Manifold Air Temperature Sensor
- Map Sensor
- Ignition Signal
- Crank Angle Sensor
- Vehicle Speed Sensor
- EGR system
- CPU (Central Processing Unit) of ECM

The ECM and "Check Engine" light operates as follows:

"Check Engine" light illuminates when the ignition switch is turned "ON" (but the engine is stopped) with the diagnosis switch terminal ungrounded regardless of the condition of EFI system. This is only to check the "Check Engine" light bulb and its circuit.

If the EFI system is free from any faults after the engine starts, the "Check Engine" light turns "OFF".

When the ECM detects a trouble which has occurred in the above areas, it turns the "Check Engine" light "ON" while the engine is running to warn the driver of the occurrence of a fault and at the same time it stores the trouble code in ECM back-up memory.

(The code is kept in memory even if the fault was only temporary and disappeared immediately. It is not erased unless the power to ECM is shut "OFF" for 20 seconds or longer.)

The ECM will indicate trouble codes that are stored in its memory by means of flashing of "Check Engine" light at the time of inspection (i.e. when diagnosis switch terminal is grounded and ignition switch is turned "ON").

NOTE: When a trouble occurs in the above systems except EGR system, and disappears while the diagnosis switch terminal is ungrounded and the engine is running, the "Check Engine" light remains "ON" as long as the trouble exists but it goes "OFF" when the normal condition is restored. When it is the EGR system where a fault occurs, even if it is only a temporary one, the "Check Engine" light remains "ON" until the ignition switch is turned "OFF". Only ignition circuit trouble (Code No. 41) is not stored in back-up memory of the ECM. (In other words, even if ECM has detected a trouble in the ignition circuit, once the ignition switch is turned "OFF", code No. 41 will not be indicated even when the diagnosis switch terminal is grounded and ignition switch is turned "ON".) Therefore, to check the diagnostic code when the engine fails to start, crank the engine and then ground the diagnostic switch terminal with ignition switch "ON".

FAIL-SAFE FUNCTION

When trouble has occurred in the EFI system and a fault is detected by the ECM, control over the injector, ISC solenoid valve and others is maintained on the basis of the calculated signals and/or back-up program prestored in the ECM. This function is called "fail-safe function". Thus, with this function, a certain level of engine performance is available even when some failure occurs and disability in running is avoided. The systems covered are as follows:

- Coolant Temperature Sensor
- Throttle Switch (M/T model) or Throttle Position Sensor (A/T model)
- Vehicle Speed Sensor
- Manifold Air Temperature Sensor
- Manifold Absolute Pressure Sensor
- CPU in ECM

INFORMATION SENSORS

Manifold Absolute Pressure (MAP) Sensor (Figure C1-2)

The MAP sensor signals the ECM as to pressure changes in the intake manifold. It consists of a semi-conductor type pressure converting element which converts a pressure change into an electrical change and an electronic circuit which amplifies and corrects the electrical change. The ECM sends a 5-volt reference voltage to the MAP sensor. As the manifold pressure changes, the electrical resistance (Figure C1-3) of the sensor also changes. By monitoring the sensor output voltage, the ECM senses the manifold pressure (intake air volume).

The ECM uses the voltage signal from the MAP sensor as one of the signals to control fuel injector, ISC solenoid valve, shift-up indicator light and EGR VSV (if equipped).

Throttle Switch (M/T model only) (Figure C1-4)

The throttle switch, consisting of 2-contact points (idle switch and wide open switch) is connected to the throttle valve shaft on the throttle body, and detects the throttle valve opening.

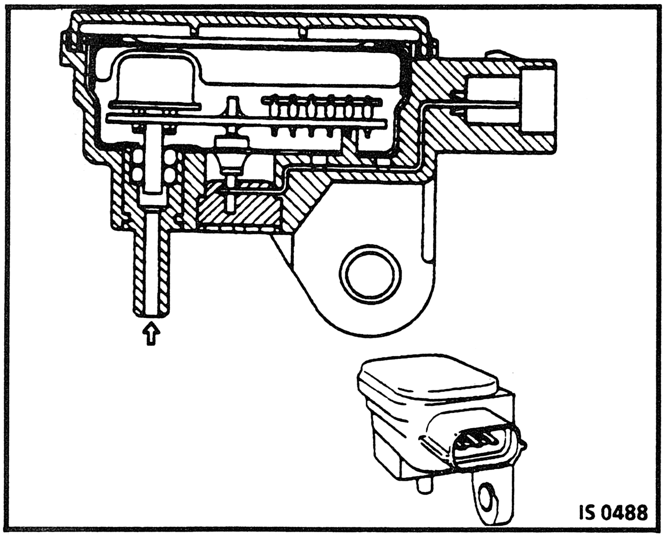


Figure C1-2 - MAP Sensor

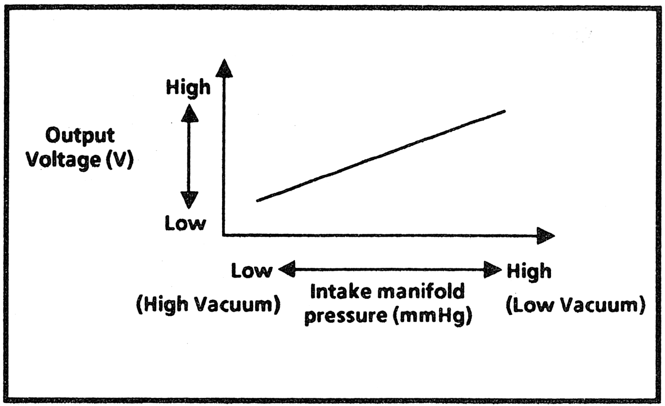


Figure C1-3 - Output Characteristic

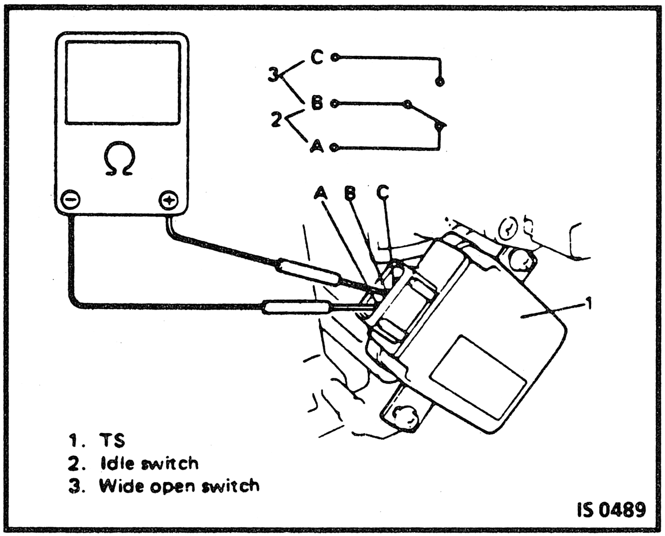


Figure C1-4 - Throttle Switch

The throttle opening in the idle state is detected by means of the idle switch, and the wide open state is detected by the wide open switch.

By monitoring their "ON"/"OFF" signals, ECM detects the throttle valve opening.

The ECM uses the "ON"/"OFF" signals from throttle switch as one of the signals to control fuel injector, ISC solenoid valve, shift light and EGR VSV (if equipped).

Throttle Position Sensor (TPS) (A/T model only) (Figure C1-5)

The TPS, consisting of a contact point (idle switch) and a potentiometer, is connected to the throttle valve shaft on the throttle body, and detects the throttle valve opening.

The throttle opening in the idle state is detected by means of the contact point which turns "ON" in that state. But beyond that the full opening is detected by the potentiometer as follows.

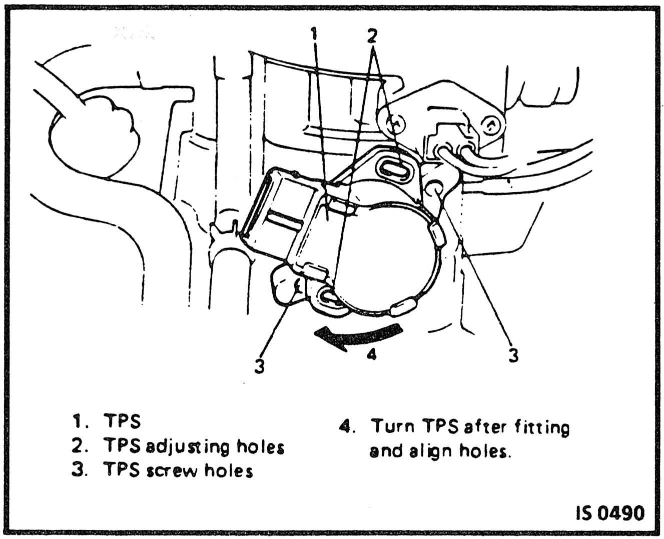


Figure C1-5 - Throttle Position Sensor

A 5-volt reference voltage is applied to the sensor from the ECM and as its brush moves over the resistance according to the throttle valve opening, the output voltage varies accordingly.

By monitoring the "ON"/"OFF" signal and sensor output voltage, ECM detects the throttle valve opening.

ECM uses the signal from the TPS as one of the signals to control (fuel injector, ISC solenoid valve and EGR VSV (if equipped).

Also, the ECM converts the voltage signal from the TPS into "ON"/"OFF" signal and sends it to A/T control module, where it is used as one of the signals to control the automatic transmission.

Manifold Air Temperature Sensor (MAT)

Located at the side of air cleaner case, the MAT sensor constantly measures the temperature of the air entering the manifold and converts a change in the air temperature. The sensor is a thermistor, that is, as air temperature lowers, resistance increases and as it rises, resistance decreases. As air temperature of the intake varies, the ECM, by monitoring the voltage drop, adjusts the amount of fuel injection according to the air temperature.

Coolant Temperature Sensor (CTS) (Figure C1-6)

Located at the side of throttle body, the CTS measures the temperature of the engine coolant. Like the air temperature sensor, the CTS is a thermistor.

That as coolant temperature lowers, resistance increases and as it rises, resistance decreases.

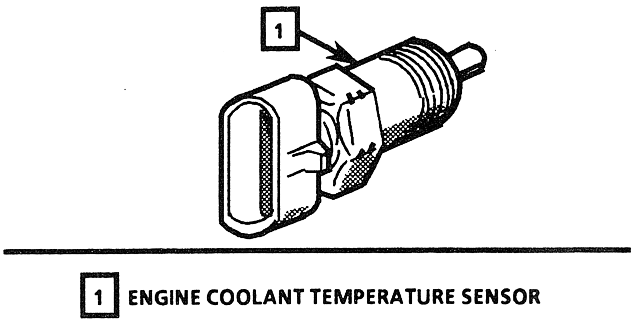


Figure C1-6 - Coolant Temperature Sensor

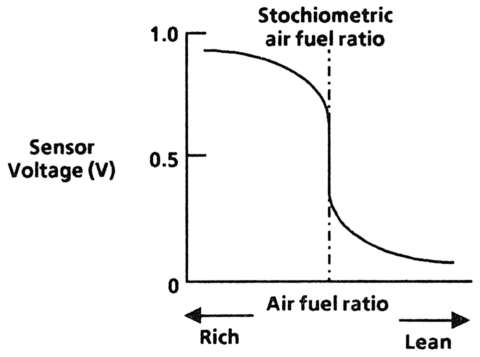


Figure C1-7 - Output Characteristic

By monitoring the voltage drop of the coolant temperature sensor, the ECM detects the engine coolant temperature and that affects most systems under the control of the ECM.

Oxygen (O_2) Sensor (Figure C1-8)

The Oxygen (O_2) sensor is located on the exhaust manifold to detect the concentration of oxygen in the exhaust gases. It consists of the zirconia element (with thin platinum surface coating) which generates electromotive force, lead wire which draws out the electromotive force and cover and housing which protect the zirconia element from damage.

The zirconia element, by its property, generates the electromotive force when a difference in oxygen concentration exists between its faces. As its temperature rises, the change of the electromotive force is amplified by catalytic reaction of the platinum. The oxygen sensor makes use of this property. Atmosphere is introduced into the oxygen sensor, the inside of the zirconia element is exposed to the atmosphere and outside to exhaust gases. Thus the difference in concentration between the inside and the outside of the zirconia element varies with the oxygen concentration in the exhaust gases.

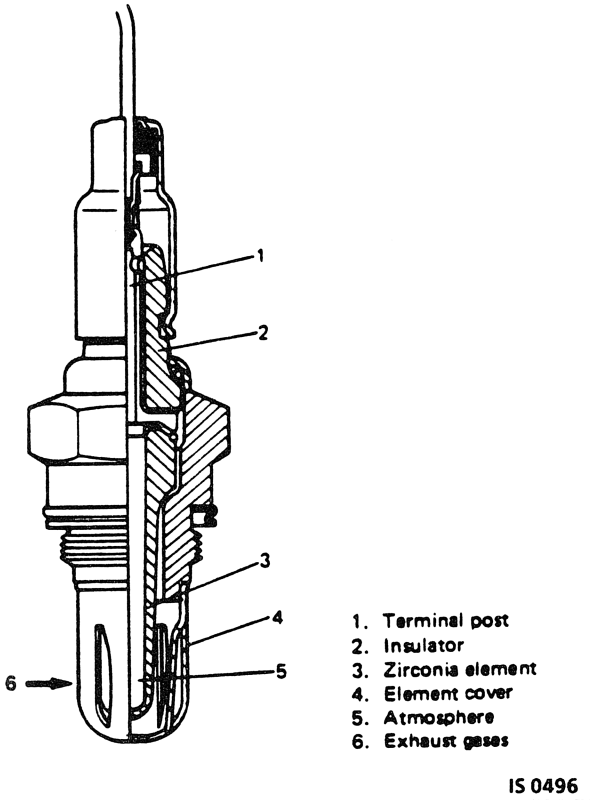


Figure C1-8 - Oxygen Sensor

The large concentration difference results in about 1V of the electromotive force and small difference results in about 1 volt. To put in other words, if the amount of oxygen in the exhaust gases is less (air-fuel mixture is richer than the stoichiometric mixture), about 1 volt of electromotive force is generated and if more (air-fuel mixture is leaner than the stoichiometric mixture), almost none is generated.

In this way, the oxygen sensor detects whether the oxygen concentration is high or low (or the mixture is leaner or richer than the stoichiometric mixture).

Vehicle Speed Sensor (VSS) (Figure C1-9)

The Vehicle Speed Sensor (VSS) consisting of the lead switch and magnet is built in the speedometer. As the magnet turns with the speedometer cable, its magnetic force causes the lead switch to turn "ON" and "OFF". Such "ON"/"OFF" frequency increases or decreases in proportion with the car speed and is sent to the ECM as pulse signals.

Crank Angle Sensor (Figure C1-10)

The crank angle sensor located in the distributor consists of the signal generator (pick-up coil and magnet) and signal rotor.

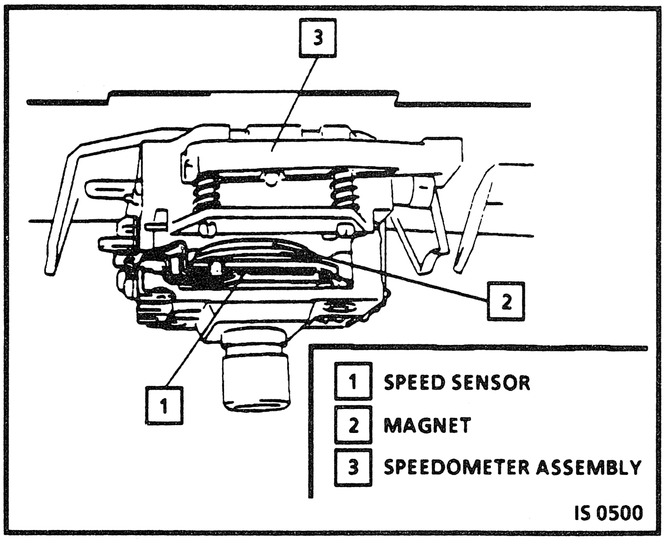

3
2
1
1 SPEED SENSOR
2 MAGNET
3 SPEEDOMETER ASSEMBLY
IS 0500

Figure C1-9 - Vehicle Speed Sensor

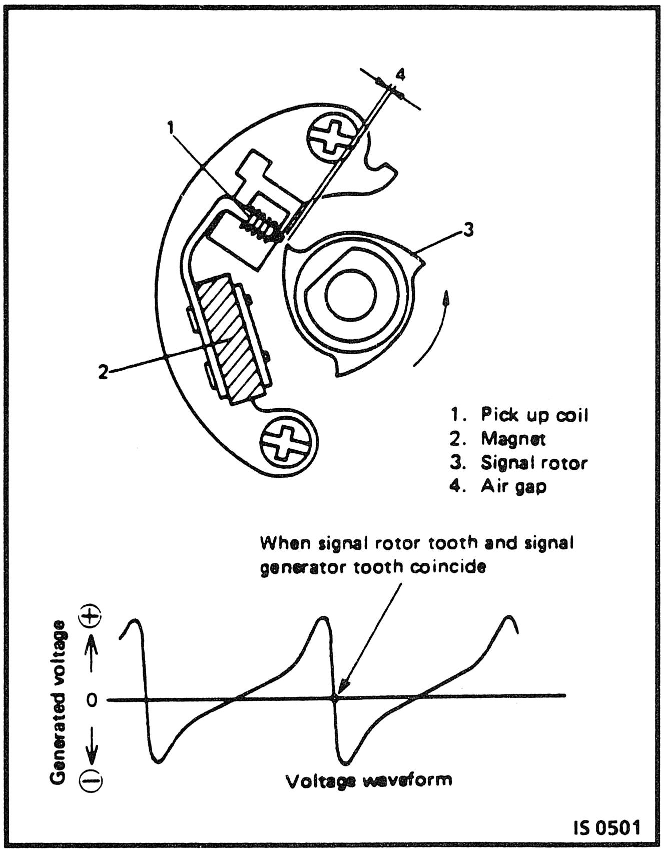

4
1
3
2
1. Pick up coil
2. Magnet
3. Signal rotor
4. Air gap
When signal rotor tooth and signal generator tooth coincide
Generated voltage
⊕
0
⊖
Voltage waveform
IS 0501

Figure C1-10 - Crank Angle Sensor

As the signal rotor turns, AC voltage is generated in the pick-up coil which varies in a pulsatory way as shown in Figure C1-10. This pulse signal (3 pulses/revolution) is sent to the ECM where it is used to calculate the engine speed and also as one of the signals to control various devices.

Engine Start Signal

This signal is sent from the engine starter circuit. Receiving it, the ECM detects that the engine is cranking and uses it as one of the signals to control the fuel injector and fuel pump relay.

"R", "D", "2" or "L" Range Signal (A/T model only)

This signal is sent from A/T control module as a battery voltage signal only when A/T is in "R", "D", "2" or "L" range. Thus, the ECM judges whether A/T is in one of the above ranges or in "P" or "N", and uses it as one of the signals to control the fuel injector and ISC solenoid valve.

Illumination Light Signal (M/T model only)

This signal is sent from the illumination light circuit. It is used to reduce intensity of the shift-up indicator light when the illumination light is "ON".

Air-Conditioner Signal (Air Conditioning Equipped Vehicles)

This signal is sent from the A/C control module. When the A/C clutch is energized the A/C control module will pull a signal line low that is in series with the A/C vacuum switching valve solenoid. The ECM uses this signal to adjust air/fuel mixture for the lean condition the A/C VSV solenoid creates. The vehicles engine speed will be increased slightly to prevent stalling.

Battery Voltage

The fuel injector is driven by its solenoid coil based upon the ECM output signal.

There is some delay called "Ineffective Injection Time", where no fuel is provided, between the ECM signal and valve action.

Since ineffective injection time depends on the battery voltage, the ECM takes voltage information to compensate for fuel injection time.

DIAGNOSIS

PRECAUTIONS IN DIAGNOSING FAULTS IN EFI SYSTEM

Precautions In Identifying Diagnostic Code

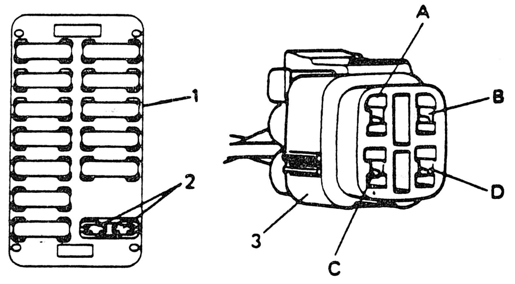
- Before identifying diagnostic codes indicated by the "Check Engine" light, don't disconnect connectors from the ECM, battery cables, ECM ground wire harness, main fuse or 15A fuse for the tail light circuit. Such disconnection will erase in ECM trouble code(s) in memory.
- If abnormality or malfunction lies in two or more areas, "Check Engine" light indicates applicable codes three times each. And flashing of these codes is repeated as long as the diagnosis terminal is grounded (spare fuse is connected) and ignition switch is "ON".
- Note of diagnostic code indicated first.
- Intermittent troubles - There are cases where the "Check Engine" light indicates a diagnostic code representing a fault which occurred only temporarily and has gone. In such case, it may occur that good parts are replaced unnecessarily. To prevent such an error, be sure to follow instructions given below when checking by using the "Diagnostic Flow Chart".
    - When trouble can be identified, that is, it is not an intermittent one:
      Check sensor (actuator), wires and each connection and if they are all in good condition.
    - When fault can not be identified but "Check Engine" light indicates a trouble code:
      Diagnose fault by using that code No. and if sensor (actuator), wires and each connection are all in good condition, erase diagnostic code in ECM memory. Then conduct a test run and check what "Check Engine" light indicates. Only when it indicates trouble code again, is the fault present.
      If it indicates no trouble code but normal Code No. 12, it means that an intermittent trouble did occur and has gone. In this case, check wires and connections carefully again.

Notes on System Circuit Inspection

- Intermittent troubles - Most intermittent problems are caused by faulty electrical connections or wiring.
  Perform careful check of suspect circuits for:
    - Poor mating of connector halves, or terminals not fully seated in connector body (backed out).
    - Improperly formed or damaged terminals. All connector terminals in problem circuit should be carefully reformed to increase contact tension.
    - Poor terminal to wire connection.
- Never connect any tester (voltmeter, ohmmeter, or whatever) to the ECM when its connector is disconnected. Attempt to do it may cause damage to the ECM.
- Never connect an ohmmeter to the ECM with its connector connected to it. Attempt to do it may cause damage to ECM and sensors.
- Be sure to use a voltmeter whose minimum resistance is more than one 1MΩ per 1 volt. Any other voltmeter should not be used because accurate measurements are not obtained. (Use J 34029-A or equivalent.)
- When checking voltage at each terminal of the connector which is connected to ECM, be sure to connect negative probe to body ground and using a jumper wire, connect ECM case to body ground.
  Applying probes of voltmeter improperly may cause the sensor or ECM to be shorted and damaged.

DIAGNOSIS SWITCH TERMINAL (Figure C1-11)

There are two diagnosis switch terminals; one included in the junction/fuel block and the other in the monitor connector in the engine compartment. When either diagnosis switch terminal is grounded, a diagnosis signal is fed to the ECM which then outputs a self-diagnosis code and at the same time fixes the "ON" time of ISC solenoid valve constant.



1. Junction/fuse block
2. Diagnosis switch terminal
3. Monitor coupler

A: A/F duty check terminal
B: Diagnosis switch terminal
C: Ground terminal
D: Test switch terminal

IS 0502

Figure C1-11 - Diagnosis and Test Switch Terminals

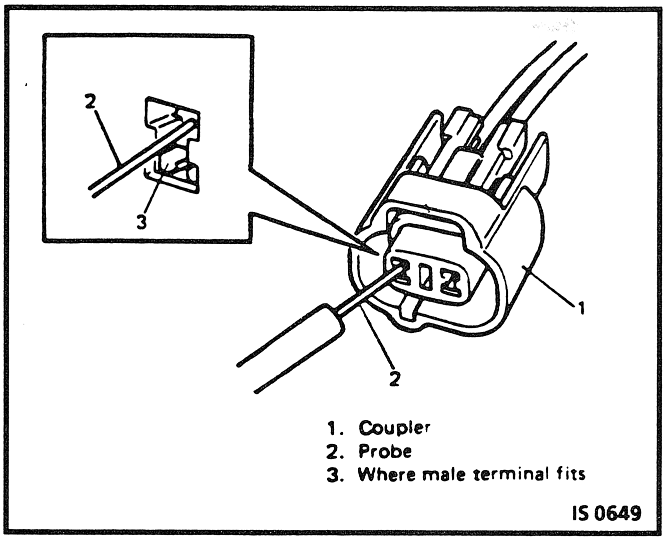


Figure C1-12 - Connecting Meter Probe

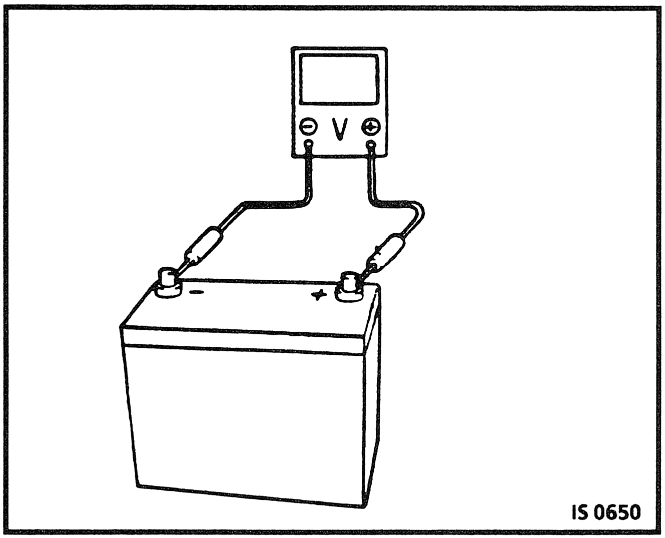


Figure C1-13 - Checking Battery Voltage

TEST SWITCH TERMINAL (Figure C1-11)

The test switch terminal is included in the monitor connector. When this terminal is grounded, the ECM sets the ignition timing to base timing.

When both test switch terminal and diagnosis switch terminal are not grounded, ECM outputs A/F duty through the A/F duty check terminal.

ISC SOLENOID VALVE

- When disconnecting and connecting connectors, make sure to turn ignition switch "OFF".
- When checking connection of terminals, check the male and female half for excessive opening and both for locking (looseness), corrosion, dust, etc.
- When connecting a probe of ohmmeter, voltmeter, etc. to connector terminal, be sure to connect it from wire harness side of connector.
- When connecting meter probe from terminal side of connector because it can't be connected from harness side, use extra care not to bend male terminal of connector or force its female terminal open. In case of a connector as shown in Figure C1-12, connect probe as shown to avoid opening female terminal. Never connect probe where male terminal is supposed to fit.
- (See Figure C1-13) Before measuring voltage at each terminal, check to make sure that battery voltage is 11 volts or higher. Such terminal voltage check at low battery voltage will lead to erroneous diagnosis.

ON-VEHICLE SERVICE

ELECTRONIC CONTROL MODULE (ECM)

Service of the ECM consists of complete replacement of the ECM. There are no serviceable parts, such as a PROM or Mem-Cal to replace inside this ECM. If the ECM is determined to be faulty, it is then to be replaced as a complete assembly.

Important

- When replacing the production ECM with a service ECM (controller), it is important to transfer the broadcast code and production ECM number to the service ECM label. Please do not record on the ECM cover. This will allow positive identification of the ECM parts throughout the service life of the vehicle.

REPLACEMENT

Remove or Disconnect

1. Negative battery cable.
2. Passenger compartment fuse block.
3. 3 fasteners from ECM bracket.
4. ECM connectors (2).
5. ECM from passenger compartment.

Install or Reconnect

1. Connectors (2) to new ECM.
2. ECM into under dash location.
3. 3 fasteners to ECM bracket.
4. Tighten securely.
5. Fuse block to mounting bracket.
6. Negative battery cable.

FUNCTIONAL CHECK

1. Turn ignition "ON".
2. Ground "Diagnosis Switch" terminal.
   A. Code 12 should "flash" 3 times. If "Check Engine" light is "ON" steady or not "ON" at all see CHART A-1.

COOLANT TEMPERATURE SENSOR (Figure C1-6)

NOTICE: Care must be used when handling coolant temperature sensor. Damage to coolant temperature sensor will affect proper operation of the fuel injection system.

Remove or Disconnect

1. Relieve coolant system pressure.
2. Ignition "OFF".
3. Air cleaner assembly.
4. Electrical connector.
5. CTS from throttle body.

Install or Connect

1. Coat thread of CTS with sealer P/N 9985253 or equivalent, torque to 25 N·m (18 lb. ft.).
2. Electrical connector.
3. Air cleaner assembly.
4. Replenish coolant system to proper level.

MANIFOLD AIR TEMPERATURE SENSOR

NOTICE: Manifold air temperature sensor is part of the air cleaner assembly. Care should be used when handling MAT sensor.

Remove or Disconnect

1. Ignition "OFF".
2. Air cleaner top and filter.
3. Electrical connector.
4. MAT sensor from air cleaner assembly.

Install or Connect

1. MAT sensor to air cleaner assembly.
2. Torque to 15 N·m (11 lb. ft.).
3. Electrical connector.
4. Air filter and cover assembly.

MANIFOLD ABSOLUTE PRESSURE SENSOR (Figure C1-2)

Remove or Disconnect

1. Ignition "OFF".
2. Vacuum hose from pressure sensor.
3. Electrical connector.
4. Fastener from MAP sensor bracket on cowl.

Install or Connect

1. Pressure sensor fastener to bracket to cowl.
2. Tighten securely.
3. Electrical connector.
4. Vacuum hose to MAP sensor.

OXYGEN SENSOR (Figure C1-8)

NOTICE: Care should be used when removing O_2 Sensor has damage will occur to the O_2 Sensor and its wire.

Important

- O_2 Sensor may be difficult to remove at temperatures below 48°C (120°F). Care should be used so as to not damage threads in exhaust manifold.

Remove or Disconnect

Important

- If exhaust manifold is hot, care should be exercised when removing O_2 sensor as to not burn yourself on a hot radiator or exhaust manifold.

1. Ignition "OFF".
2. Electrical connector.
3. O_2 sensor from exhaust manifold.

Install or Connect

Important

- The O_2 sensor comes with anti-sieze coating on the new sensor. Care should be used as to not remove any of this coating.

1. O_2 sensor to exhaust manifold.
2. Torque to 41 N·m (30 lb. ft.).
3. Electrical connector.

THROTTLE SWITCH (M/T ONLY) (Figure C1-4)

Remove or Disconnect

1. Ignition "OFF".
2. Air cleaner assembly from throttle body.
3. Electrical connect from throttle switch.
4. 2 attaching screws.
5. Throttle switch.

Install or Connect

1. Throttle switch to throttle body.
2. 2 attaching screws.

Adjust

- For adjustment of throttle switch refer to procedure in Section "C2".

3. Torque attaching screws to 2 N·m (18 lb. in.).
4. Electrical connector.
5. Air cleaner assembly to throttle body.

THROTTLE POSITION SENSOR (A/T ONLY) (Figure C1-5)

Remove or Disconnect

1. Ignition "OFF".
2. Air cleaner assembly from throttle body.
3. Electrical connector.
4. 2 attaching screws
5. Throttle position sensor.

Install or Connect

1. Throttle position sensor.
2. 2 attaching screws.

Adjust

- For adjustment of throttle procedure refer to Section "C2".

3. Torque 2 attaching screws to 2 N·m (18 lb. in.).
4. Electrical connector.
5. Air cleaner assembly to throttle body.

PARTS INFORMATION

PART NAME	GROUP
Throttle Switch (M/T only)	3.339
Manifold Absolute Pressure Sensor	3.682
Controller, ECM	3.670
Throttle Position Sensor (A/T only)	3.320
Coolant Temperature Sensor (CTS)	3.682
Manifold Air Temperature Sensor (MAT)	3.682
Oxygen Sensor	3.704
Vehicle Speed Sensor (VSS)	3.682

SECTION C2

FUEL METERING SYSTEM

CONTENTS

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TORQUE SPECIFICATIONS C2-16

GENERAL DESCRIPTION

The function of the fuel metering system is to deliver the correct amount of fuel to the engine under all operating conditions. Fuel is delivered by the Throttle Body Injection (TBI) unit, which is controlled by the Electronic Control Module (ECM), based on several important engine operation parameters. These parameters include engine speed, manifold pressure, engine coolant temperature, throttle position, and exhaust oxygen content.

The fuel metering system consists of the air/fuel delivery system and the electronic control system. This section covers the air/fuel delivery system. For information on the "Electronic Control System", refer to Section "C1" in this manual.

AIR/FUEL DELIVERY SYSTEM (Figure C2-1)

The main components of this system are the fuel tank, fuel pump, fuel filter, throttle body (including fuel injector, fuel pressure regulator and air valve), fuel feed line, fuel return line, air cleaner and ISC solenoid valve.

The fuel in the fuel tank is pumped up by the fuel pump, filtered by the fuel filter and fed under pressure to the injector installed in the throttle body. Fuel pressure applied to the fuel injector (the fuel pressure in the fuel feed line) is always kept a certain amount higher than the pressure in the intake manifold by the fuel pressure regulator. The fuel is injected into the throttle body in conic dispersion when the injector opens according to the injection signal from ECM. The fuel pressure that is relieved by the pressure regulator is returned to the fuel tank through the fuel return line. The injected fuel is mixed with the air which has been filtered through the air cleaner in the throttle body. The air/fuel mixture is drawn through clearance between throttle valve and bore and idle bypass passage into the intake manifold. Then the intake manifold distributes the air/fuel mixture to each combustion chamber.

When the engine is cold, the air is drawn through air valve bypassing the throttle valve into the intake manifold.

When ISC solenoid valve opens according to the signal from ECM, the air is drawn through a hose bypassing the throttle valve into the intake manifold.

For the structure and operation of the fuel tank and filter, refer to ENGINE FUEL (SECTION 6C).

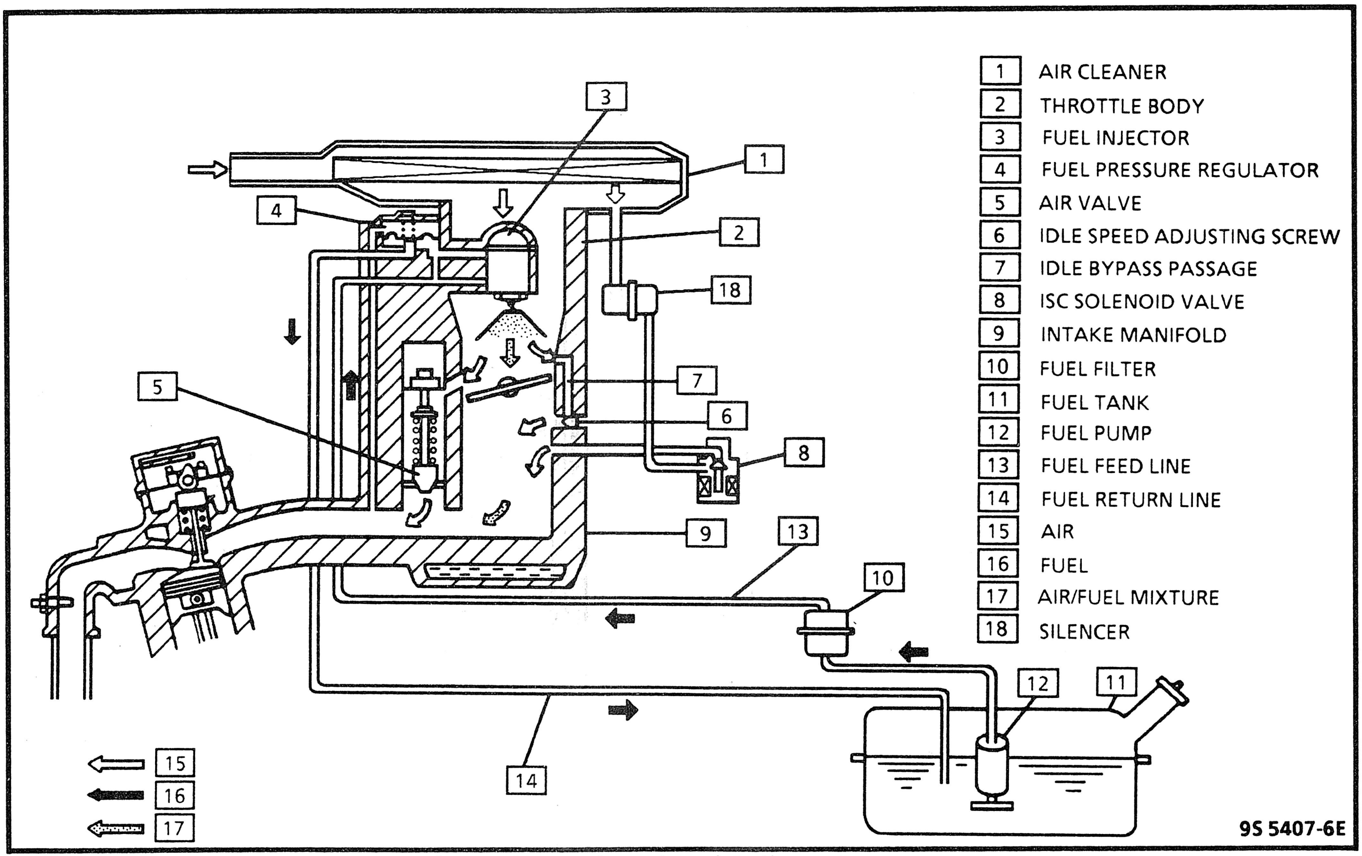

1 AIR CLEANER
2 THROTTLE BODY
3 FUEL INJECTOR
4 FUEL PRESSURE REGULATOR
5 AIR VALVE
6 IDLE SPEED ADJUSTING SCREW
7 IDLE BYPASS PASSAGE
8 ISC SOLENOID VALVE
9 INTAKE MANIFOLD
10 FUEL FILTER
11 FUEL TANK
12 FUEL PUMP
13 FUEL FEED LINE
14 FUEL RETURN LINE
15 AIR
16 FUEL
17 AIR/FUEL MIXTURE
18 SILENCER
9S 5407-6E

Figure C2-1 - Air and Fuel Delivery System

FUEL INJECTION OPERATION (Figure C2-4)

In this system, the ECM controls the "ON" time (length of pulse) and timing of the fuel injection from the fuel injector into the throttle body according to the signals from the various sensors so that suitable air/fuel mixture is supplied to the engine in each driving condition.

There are two types of injection timing. One is "synchronous injection" in which injection is synchronous with the ignition signal (or signal from crank angle sensor) and the other is "asynchronous injection" in which injection takes place independently of the ignition signal (or signal from crank angle sensor).

The factors to determine the injection time are the basic injection time which is calculated on the basis of the engine speed and the intake manifold pressure (amount of the intake air) and various compensations which are determined according to the signals from various sensors that detect the state of the engine and driving conditions.

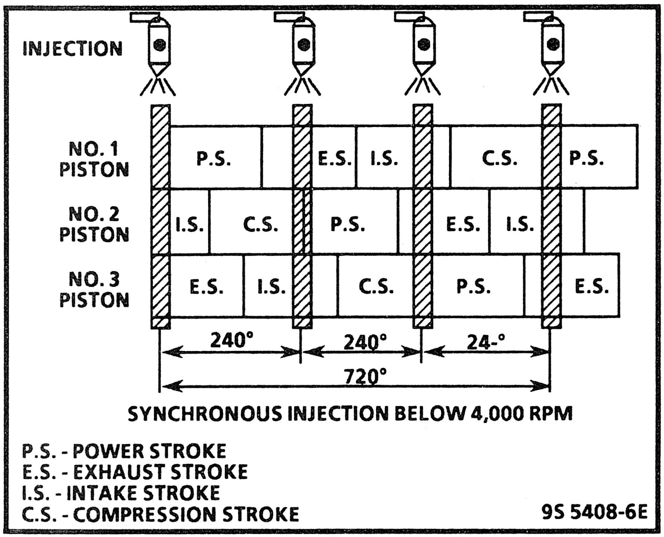

INJECTION
NO. 1 PISTON
P.S.
E.S.
I.S.
C.S.
P.S.
NO. 2 PISTON
I.S.
C.S.
P.S.
E.S.
I.S.
NO. 3 PISTON
E.S.
I.S.
C.S.
P.S.
E.S.
240°
240°
240°
720°
SYNCHRONOUS INJECTION BELOW 4,000 RPM
P.S. - POWER STROKE
E.S. - EXHAUST STROKE
I.S. - INTAKE STROKE
C.S. - COMPRESSION STROKE
9S 5408-6E

Figure C2-2 - Synchronous Injection

Synchronous Injection (Figure C2-2)

Normally, the injector injects fuel at every ignition signal (or at every signal from crank angle sensor). But when the engine coolant temperature is low immediately after its start, the injection time for one ignition cycle is divided into cycles and injection takes place accordingly.

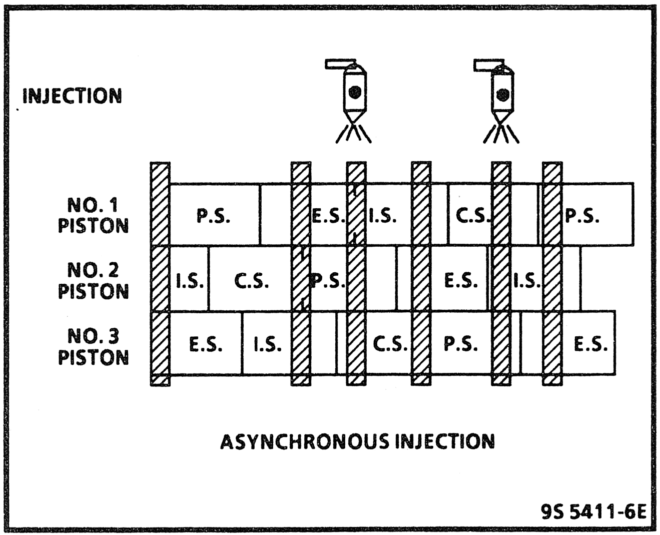

INJECTION
NO. 1 PISTON
P.S.
E.S.
I.S.
C.S.
P.S.
NO. 2 PISTON
I.S.
C.S.
P.S.
E.S.
I.S.
NO. 3 PISTON
E.S.
I.S.
C.S.
P.S.
E.S.
ASYNCHRONOUS INJECTION
9S 5411-6E

Figure C2-3 - Asynchronous Injection

Asynchronous Injection (Figure C2-3)

When the throttle valve is opened from its idle position, the injector injects fuel in addition to synchronous injection independently of the ignition signal (or signal from the crank angle sensor).

Engine Starting Enrichment

In order to improve starting performance, enriching compensation at start is carried out. For a certain time after the engine is started, air/fuel mixture enriching compensation is made so as to stabilize the engine speed. The amount of compensation varies depending on the engine coolant temperature.

Engine Warm-Up Enrichment

When the engine is cold, enriching compensation is made to ensure good driveability until the engine coolant temperature reaches the specified level. The amount to enrich the air/fuel mixture is decreased as the temperature rises.

Acceleration Enrichment

To ensure smooth acceleration, enriching compensation is carried out when the intake manifold pressure varies by more than a specified amount during acceleration. The amount of compensation is determined according to the engine coolant temperature and how much the intake manifold pressure varies.

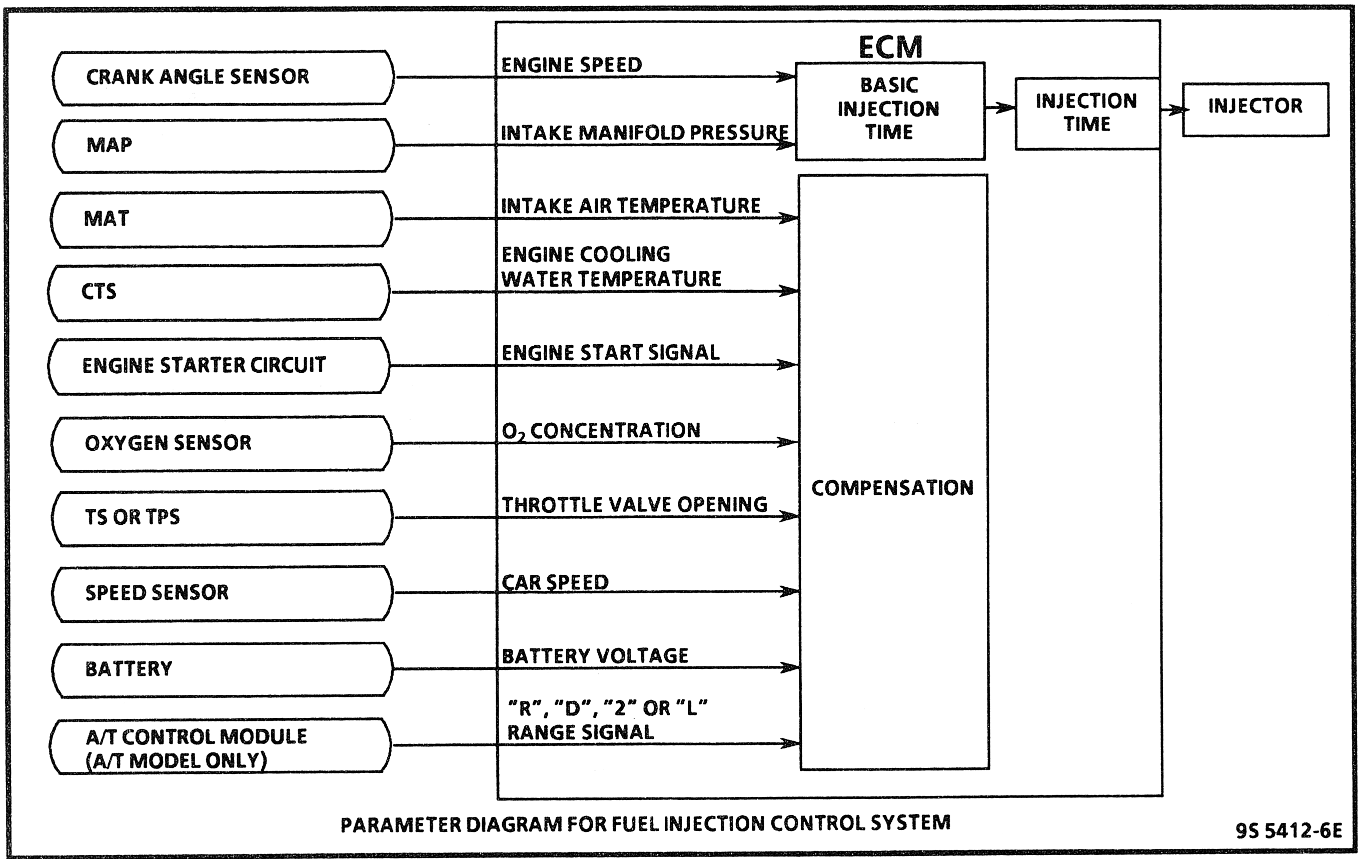

CRANK ANGLE SENSOR
MAP
MAT
CTS
ENGINE STARTER CIRCUIT
OXYGEN SENSOR
TS OR TPS
SPEED SENSOR
BATTERY
A/T CONTROL MODULE (A/T MODEL ONLY)
ENGINE SPEED
INTAKE MANIFOLD PRESSURE
INTAKE AIR TEMPERATURE
ENGINE COOLING WATER TEMPERATURE
ENGINE START SIGNAL
O_2 CONCENTRATION
THROTTLE VALVE OPENING
CAR SPEED
BATTERY VOLTAGE
"R", "D", "2" OR "L" RANGE SIGNAL
ECM
BASIC INJECTION TIME
COMPENSATION
INJECTION TIME
INJECTOR
PARAMETER DIAGRAM FOR FUEL INJECTION CONTROL SYSTEM
9S 5412-6E

Figure C2-4 - Parameter Diagram for Fuel Injection Control System

Power Enrichment

To provide maximum power during high load driving conditions, the air/fuel mixture is made richer to ensure that all the available air is used during combustion.

Deceleration Enleanment

To obtain a proper air/fuel mixture ratio during deceleration, leaning compensation is carried out when the intake manifold pressure varies by more than a specified amount during deceleration.

Battery Voltage Compensation

A power voltage drop delays the mechanical operation of the injector. Then the actual injection time becomes shorter for the time that electricity is supplied to the injector. To compensate this, the electricity supply time is made longer when the voltage is lower.

Base Air/Fuel Ratio Compensation

The air/fuel ratio may vary due to such factors as variation in each engine itself and aging.

To compensate such variation, feed back compensation is used and base air/fuel mixture ratio is adjusted to a proper level for feed back compensation.

Fuel Cut-Off

Fuel injection stops (with operation of the injector prevented) when decelerating (i.e. when the throttle valve is at idle position and the engine speed is high), so that unburned gas will not be exhausted and it starts again when above conditions are not met.

The fuel injection also stops when the engine speed exceeds 7,000 rpm to prevent over-run which affects the engine adversely and it starts again when the engine speed reduces to less than 6,800 rpm.

Air/Fuel Ratio Feed Back Compensation (Closed - Loop Operation)

It is necessary to keep the air/fuel mixture close to the theoretical air/fuel ratio (14.7) to obtain efficient performance of the 3-way catalyst and high clarification rate of CO, HC and NOx in the exhaust gas. For that purpose, ECM operates as follows. It first compares the signal from the oxygen sensor with a specified reference voltage and if the signal is higher, it detects that the air/fuel ratio is richer than the theoretical air /fuel ratio and reduces fuel. On the other hand, if the signal is lower, it detects that the air/fuel ratio is leaner and increases fuel. By repeating these operations, it adjusts the air/fuel ratio closer to the theoretical air/fuel ratio.

1) When oxygen concentration in the exhaust gas is low, that is, when the air/fuel ratio is smaller than the theoretical air/fuel ratio (fuel is richer), electromotive force of the oxygen sensor increases and a rich signal is sent to ECM.
2) Upon receipt of the rich signal, ECM decreases the amount of fuel injection, which causes oxygen concentration in the exhaust gas to increase and electromotive force of the oxygen sensor to decrease. Then a lean signal is sent to ECM.
3) As ECM increases the amount of fuel injection according to the lean signal, oxygen concentration in the exhaust gas decreases and the condition is back to the situation described in step 1.

This control process, however, will not take place under any of the following conditions:

- At engine start and when fuel injection is increased after engine start
- When engine coolant temperature is low
- When highly loaded and fuel injection is increased
- At fuel cut-off
- When oxygen sensor is cold
- When engine is running at high speed (higher than about 4000 rpm).

ENGINE IDLE SPEED CONTROL OPERATION

Engine idle speed is controlled by the ECM through the Idle Speed Control (ISC) solenoid valve which allows more/less air to bypass the throttle valve. The reasons for idle speed control are:

- To keep the engine idle speed as specified at all times. The engine idle speed can vary due to the following reasons:
  - Load applied to engine (when electric load is applied, automatic transmission is shifted to "R", "D", "2" or "L" range, air-conditioner is turned "ON," etc.)
  - Variation in atmospheric pressure
  - Change in engine itself with passage of time
  - Other factors causing idle speed to change
- To improve starting performance of engine
- To compensate air/fuel mixture ratio when decelerating (dash-pot effect)

The ISC solenoid valve opens the bypass air passage when it is turned "ON" by ECM and closes it when turned "OFF."

ECM detects the engine condition by using signals from various sensors and switches and while repeating "ON" and "OFF" cycle of ISC solenoid valve at a certain rate (12 times a second), it controls bypass air flow by increasing and decreasing its "ON" time within a cycle.

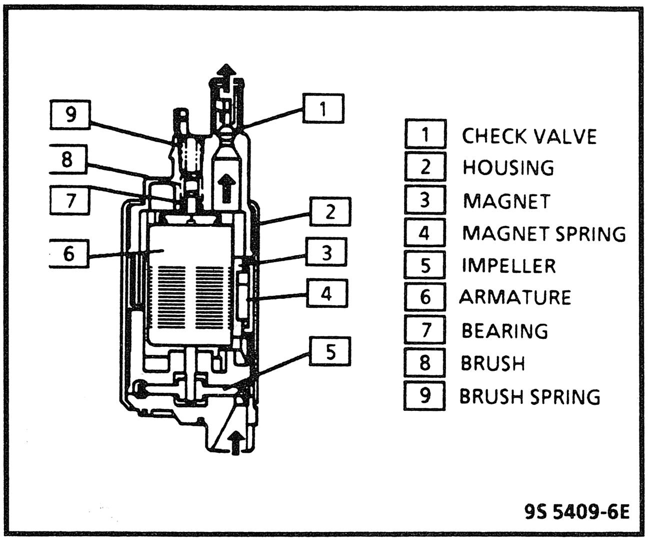

1
2
3
4
5
6
7
8
9
1 CHECK VALVE
2 HOUSING
3 MAGNET
4 MAGNET SPRING
5 IMPELLER
6 ARMATURE
7 BEARING
8 BRUSH
9 BRUSH SPRING
9S 5409-6E

Figure C2-5 - Fuel Pump

While the engine is cranking, the ECM keeps the ISC solenoid valve "ON" so as to obtain better start of the engine. After the engine has started, it reduces "ON" time gradually to maintain the idle speed as specified.

When the accelerator pedal is depressed (throttle valve is at other than idle), the ECM keeps the ISC solenoid valve "ON." When decelerating, on the other hand, it reduces its "ON" time gradually (thereby reducing the bypass air flow gradually) to adjust air/fuel mixture to an optimum ratio for combustion.

When the car is at a stop, the throttle valve is at the idle position and the engine is running, ECM controls the bypass air flow by increasing or decreasing "ON" time of the ISC solenoid valve so that the engine speed is kept at a specified idle speed.

With an air-conditioner equipped car, when the air-conditioner is "ON," a certain amount of the bypass air is supplied by the air-conditioner Vacuum Switching Valve (VSV) independently of the ISC valve bypass air circuit. The VSV bypass air is used for fine control of engine idle speed.

Important

- The vacuum switching valve automatically adjusts the engine idle speed to specification by means of ECM. If such specified idle speed is not available, it is necessary to adjust the basic idle speed with the idle speed adjusting screw. See "Idle Speed/A/C VSV Adjustment Procedure" in this section.

FUEL PUMP
(Figure C2-5)

The ECM controlled electric fuel pump is located in the fuel tank, and consists of an armature, a magnet, an impeller, a brush set, a check valve, etc.

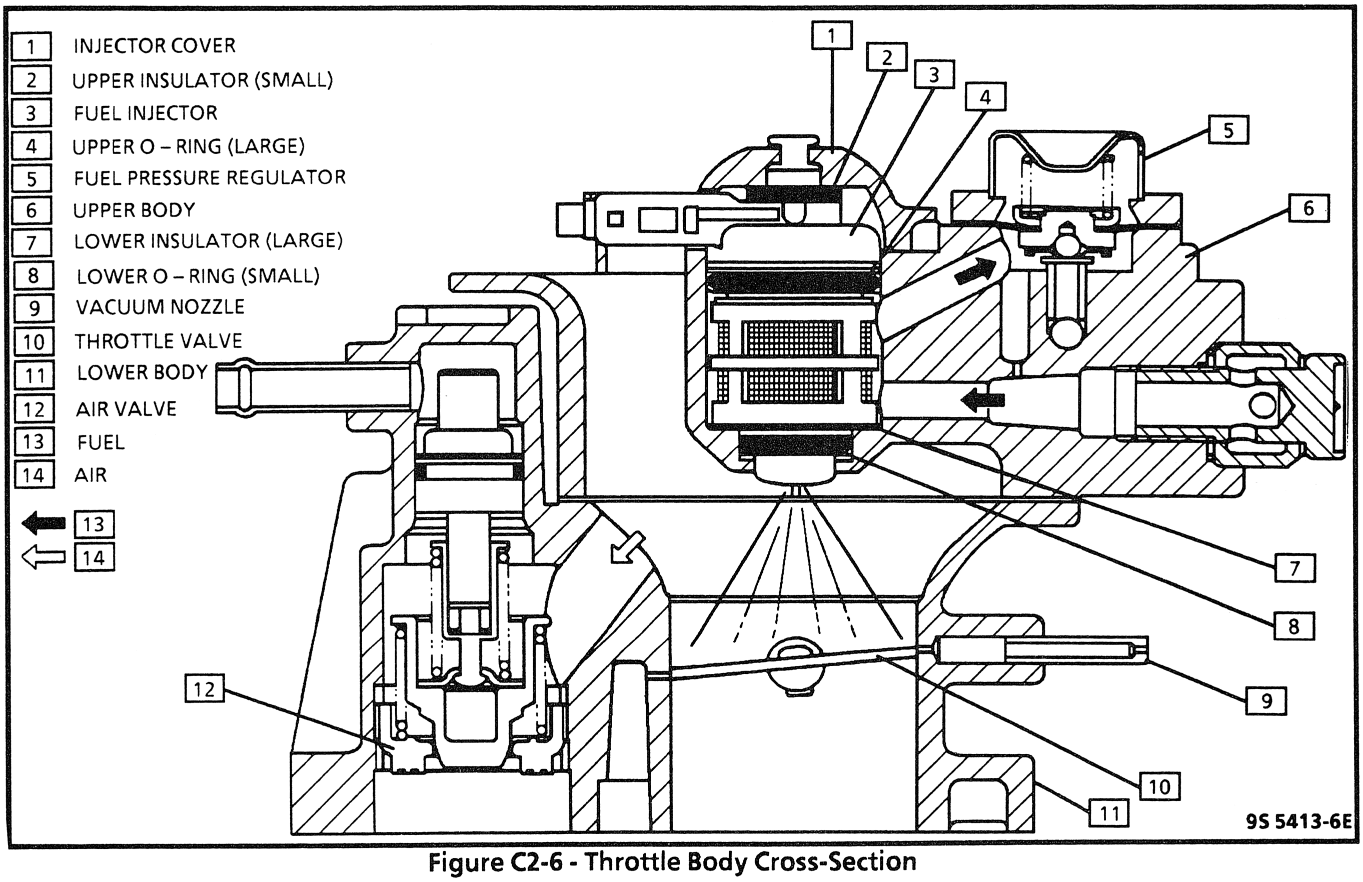

1 INJECTOR COVER
2 UPPER INSULATOR (SMALL)
3 FUEL INJECTOR
4 UPPER O – RING (LARGE)
5 FUEL PRESSURE REGULATOR
6 UPPER BODY
7 LOWER INSULATOR (LARGE)
8 LOWER O – RING (SMALL)
9 VACUUM NOZZLE
10 THROTTLE VALVE
11 LOWER BODY
12 AIR VALVE
13 FUEL
14 AIR
13
14
1
2
3
4
5
6
7
8
9
10
11
12
9S 5413-6E

Figure C2-6 - Throttle Body Cross-Section

FUEL PUMP ELECTRIC CIRCUIT

ECM controls "ON"/"OFF" operation of the fuel pump by turning it "ON" via the fuel pump relay under any of the following conditions.

- For 2 seconds after ignition switch "ON."
- While cranking engine (while engine start signal is received by the ECM).
- Crank angle sensor signal is received by the ECM.

When power is supplied to the fuel pump, the motor in the pump runs and so does the impeller. This causes a pressure difference to occur between both sides of the impeller as there are many grooves around it. Then the fuel is drawn through the inlet port, and with its pressure increased it is discharged through the outlet port. The fuel pump also has a check valve to keep some pressure in the fuel feed line even when the fuel pump is stopped.

THROTTLE BODY INJECTION UNIT (Figure C2-6)

The throttle body consists of the main bore, air and/or fuel passage, vacuum passage (for pressure sensor, ignition timing vacuum advancer, evaporative emission control system and EGR system), air induction passage and the following parts.

- Fuel injector which injects fuel according to the signal from the ECM.
- Fuel pressure regulator which maintains the fuel pressure to the injector a certain amount higher than the pressure in the intake manifold.
- Throttle valve which is interlocked with the accelerator pedal and controls the amount of the air/fuel mixture drawn into the combustion chamber.
- Air valve which supplies the bypass air when engine is cold.
- Idle speed adjusting screw which controls the amount of bypass air to adjust engine idle speed.
- TS (M/T model) or TPS (A/T model) which detects the throttle valve opening and sends a signal to the ECM.

Fuel Injector (Figure C2-7)

The fuel injector is an electromagnetic type injection nozzle which injects fuel in the throttle body bore according to the signal from the ECM.

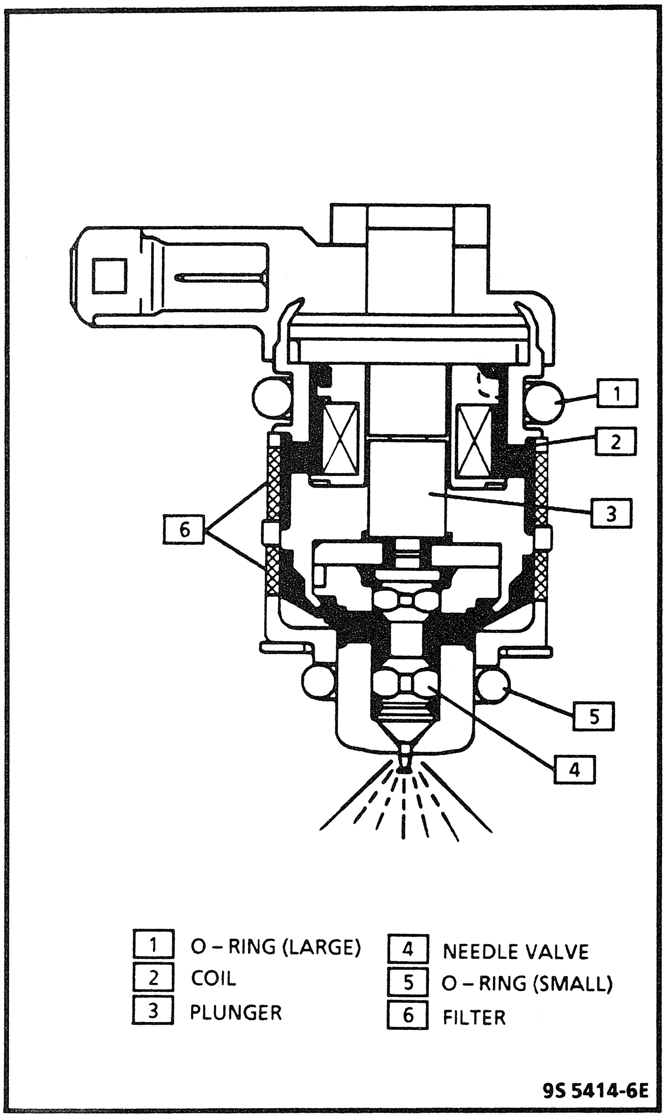


Figure C2-7 - Fuel Injector Cross-Section

When the solenoid coil of the injector is energized by the ECM, it becomes an electromagnet and attracts the plunger. At the same time, the needle valve which is incorporated with the plunger opens and the injector which is under the fuel pressure injects fuel in conic dispersion. As the stroke of the needle valve of the injector is set constant, the amount of fuel injected at one time is determined by the length of time during which the solenoid coil is energized (injection time).

Fuel Pressure Regulator (Figure C2-8)

The fuel pressure regulator is diaphragm-operated relief valve consisting of diaphragm, spring and valve. It keeps the fuel pressure applied to the injector 1.8 kg/cm^2 (180 kPa, 25.6 psi) higher than that in the intake manifold at all times.

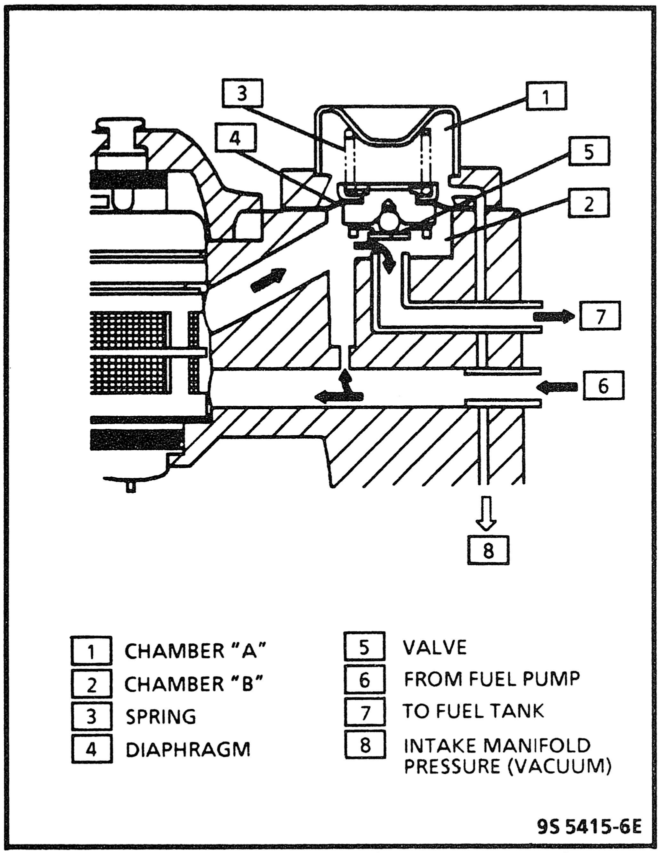

1
2
3
4
5
6
7
8
1 CHAMBER "A"
2 CHAMBER "B"
3 SPRING
4 DIAPHRAGM
5 VALVE
6 FROM FUEL PUMP
7 TO FUEL TANK
8 INTAKE MANIFOLD PRESSURE (VACUUM)
9S 5415-6E

Figure C2-8 - Pressure Regulator Cross-Section

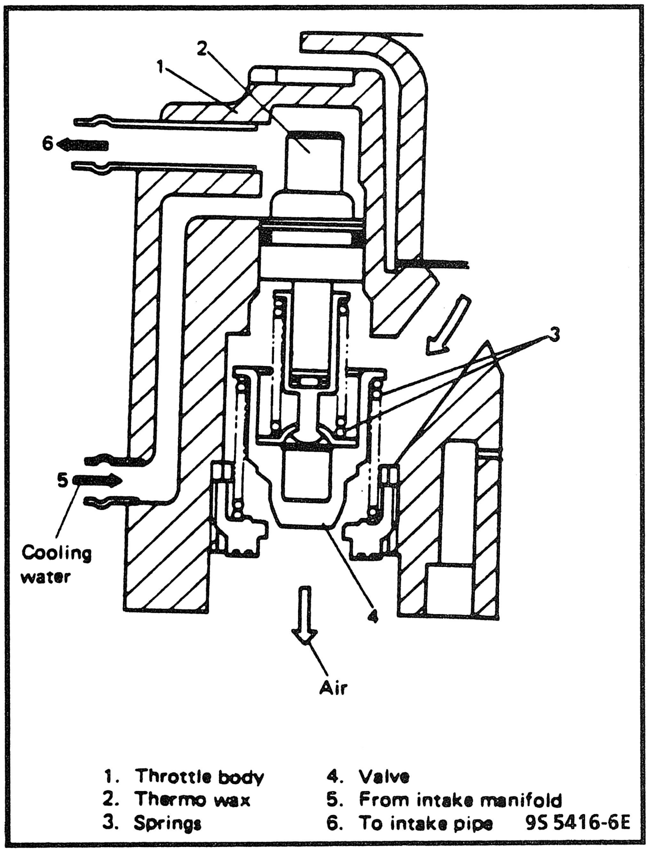

1
2
3
4
5
6
Cooling water
Air
1. Throttle body
2. Thermo wax
3. Springs
4. Valve
5. From intake manifold
6. To intake pipe
9S 5416-6E

Figure C2-9 - Opening Air Valve

The pressure applied to the chamber "A" of fuel pressure regulator is intake manifold pressure and that to the chamber "B" is fuel pressure (Figure C2-8). When the fuel pressure rises more than 1.8 kg/cm^2 (180 kPa, 25.6 psi) higher than the intake manifold pressure, the fuel pushes the valve in the regulator open and excess fuel returns to the fuel tank via the return line.

Air Valve (Figure C2-9)

The air valve consists of thermo-wax, springs and a valve. When the engine is cold (or engine coolant is lower than about 60°C (140°F)), the thermo-wax contracts. In this state, the valve opens by the spring force, allowing the air to be drawn into the intake manifold. Thus the amount of intake air increases even when the throttle valve is at the idle position and the engine speed rises to the fast idle state which is higher than the idle speed.

As the engine is warmed up, the thermo-wax expands gradually, then the piston pushes down the valve gradually, and the amount of air passing through the air valve decreases and so does the engine speed. When the engine coolant temperature reaches about 60°C (140°F), the valve is fully closed and the engine speed is back to the normal idle speed.

Idle Speed Control (ISC) Solenoid Valve (Figure C2-11)

The ISC solenoid valve opens and closes the air bypass passage according to the signal from ECM. When it opens, the air is supplied to the intake manifold.

ON-VEHICLE SERVICE

Important

- When hoses have been disconnected and system components removed for service, be sure to reinstall components properly, and route and connect hoses correctly after service. Refer to "Emission Control Information Label" for proper routing of hoses.

IDLE SPEED CHECK AND ADJUSTMENT

Important

- Before starting engine place transaxle gear selector in Park (Neutral for M/T) and set parking brake and block drive wheels.

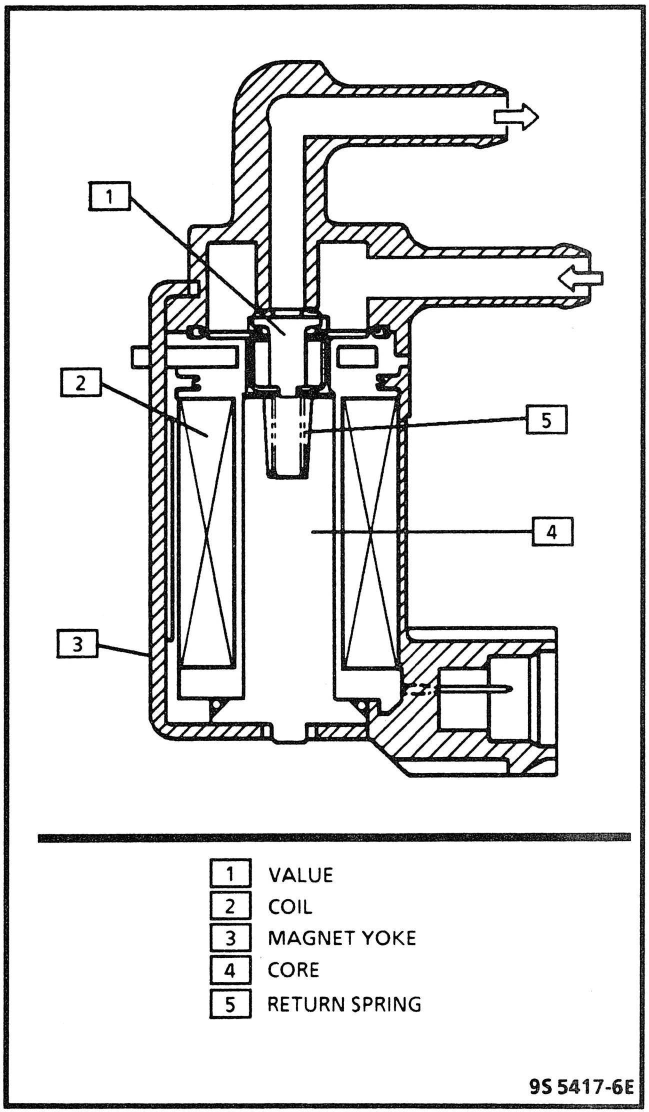

1 VALUE
2 COIL
3 MAGNET YOKE
4 CORE
5 RETURN SPRING
9S 5417-6E

Figure C2-10 - Solenoid Valve Cross-Section

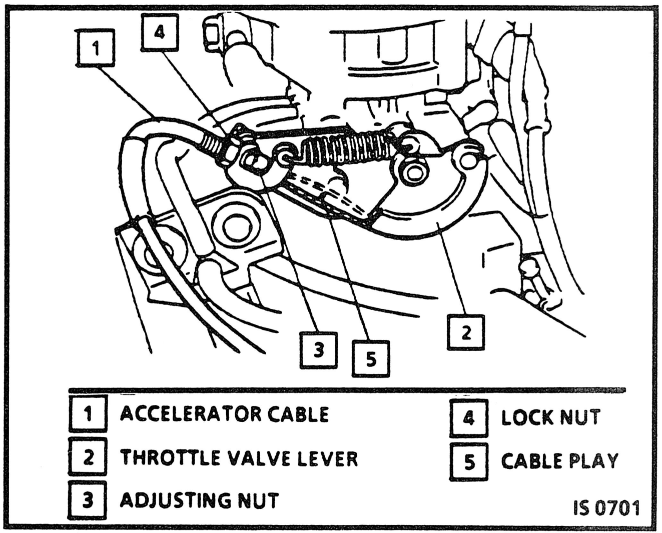

1 ACCELERATOR CABLE
2 THROTTLE VALVE LEVER
3 ADJUSTING NUT
4 LOCK NUT
5 CABLE PLAY
IS 0701

Figure C2-11 - Accelerator Cable Adjustment

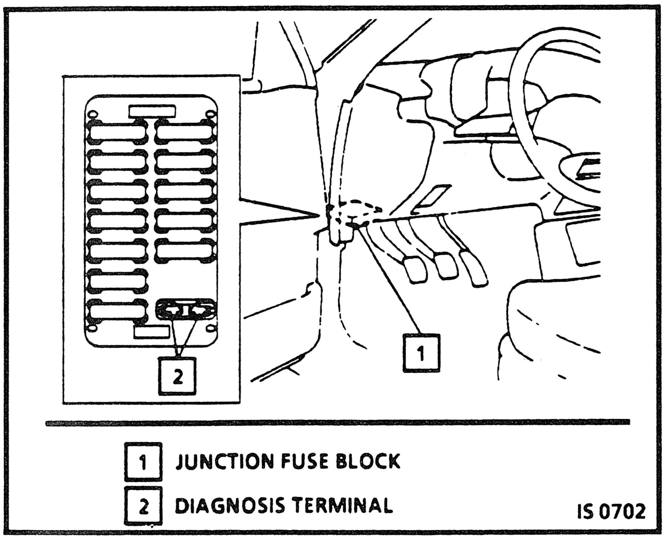

1 JUNCTION FUSE BLOCK
2 DIAGNOSIS TERMINAL
IS 0702

Figure C2-12 - Diagnosis Switch Terminal

1. Check accelerator cable for free movement and excessive play, cable play should be within specification. If out of specification adjust (Figure C2-11):
   a. Loosen accelerator able lock nut.
   b. Adjust cable play to .12 - .20 in. (3-5 mm).
2. Inspect lead wires and hoses of EFI and engine emissions control systems for being connected securely.
3. Check accelerator cable for proper play.
4. Check ignition timing, and adjust if necessary.
5. Turn "OFF" all accessories (A/C, wipers, heater, lights, etc.).
6. Make sure air cleaner is installed correctly.
7. Remove cover on idle speed adjusting screw.
8. Start engine and allow it to reach normal operating temperature idle (accessories "OFF").
9. Connect a tachometer.
10. Install a spare fuse to diagnosis switch terminal in fuse block, see Figure C2-12.
11. Check idle speed. It should be:
    - 700 ± 50 rpm A/T Metro LSI only)
    - 850 ± 50 rpm A/T
    - 750 ± 50 rpm M/T

    If idle speed is okay, proceed to steps 13 through 16.
12. If necessary, adjust idle speed to correct idle speed by turning idle speed adjusting screw "IN" to increase or "OUT" to decrease idle speed. See Figure C2-13.
13. Remove spare fuse from diagnosis switch terminal (Figure C2-12).
14. Disconnect tachometer.
15. Install idle speed screw cover.
16. Install air cleaner assembly and related hoses.

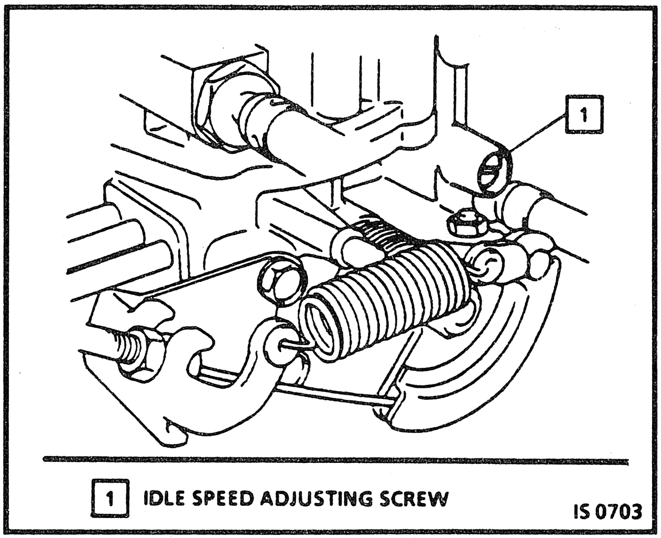


Figure C2-13 - Idle Speed Adjusting Screw

IDLE SPEED / A/C VSV ADJUSTMENT

Adjust (Figure C2-14)

1. Remove air cleaner assembly.
2. Start engine and allow it to reach normal operating temperature (with A/C "ON").
3. Connect a tachometer.
4. Install a spare fuse in diagnosis switch terminal (Figure C2-12).
5. Check idle speed, adjust as necessary by adjusting the A/C vacuum switch valve idle screw.
   - 850 ± 50 rpm A/T
   - 900 ± 50 rpm M/T
6. Remove spare fuse from diagnosis switch terminal.
7. Disconnect tachometer.
8. Install air cleaner assembly.
9. Check idle speed. Adjust as necessary to reach specification stated in step "5".

FUEL PRESSURE RELIEF PROCEDURE

CAUTION: **To reduce the risk of fire and personal injury, it is necessary to relieve the fuel system pressure before servicing the fuel system.**

1. Loosen fuel filler cap to relieve tank vapor pressure.
2. Place transaxle gear shift lever in Neutral or Park for A/T models. Set parking brake and block drive wheels.
3. Remove main fuse block cover and engine coolant reservoir from its bracket.
4. Remove screws holding main fuse block.
5. Remove coupler holding fuel pump relay and disconnect. Fuel pump relay, see Figure C2-15.
6. Start engine and run until it stalls. Crank engine for 3 seconds to insure there is no fuel left in lines.

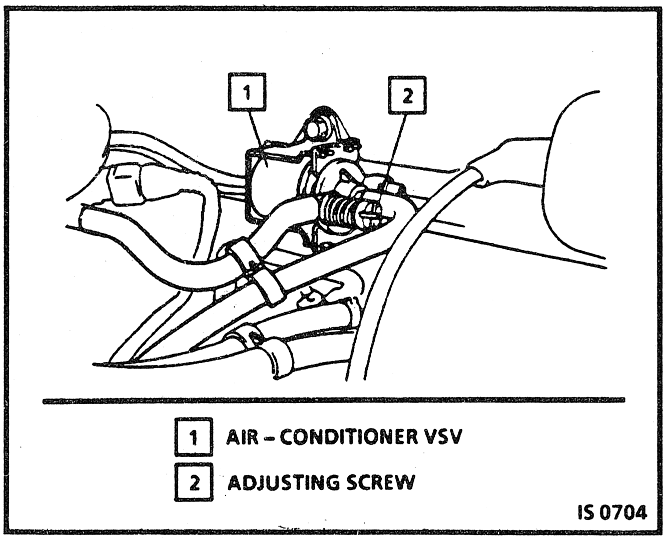


Figure C2-14 - Adjusting Screw for A/C VSV

7. After completing repair. Reverse steps 2-4.

CAUTION: **After relieving system pressure, a small amount of fuel may be released when servicing fuel lines or connections. In order to reduce the chance of personal injury, cover fuel line fittings with a shop towel before disconnecting, to catch any fuel that may leak out. Place the towel in an approved container when disconnect is completed.**

FUEL SYSTEM PRESSURE TEST

A fuel system pressure test is a part of several diagnostic charts and symptoms checks. To perform this test, follow this procedure:

1. Relieve fuel pressure using the procedure in this section.
2. Disconnect negative battery cable.
3. Remove air cleaner assembly.
4. Disconnect fuel feed hose from throttle body.
5. Install fuel pressure gauge (J 34730-1), and T-Fitting (J 34730-75) between fuel feed line and throttle body. Clamp securely to ensure that no leaks occur. See Figure C2-16.
6. Start engine, and idle at normal operating temperature.
7. Check fuel pressure as follows:
   Idling - 90-140 kPa (13-20 psi)
   Engine "OFF", Ignition "ON"
   158-210 kPa (23-30.5 psi)
   Engine "OFF", Ignition "ON"
   (Pressure reduces as time passes)
   If pressure is not within specification, refer to CHART A-5 or A-7.

8. Relieve fuel pressure using the procedure in this section.
9. Disconnect fuel pressure gauge assembly.
10. Connect fuel feed line to throttle body.
11. Install air cleaner assembly.
12. Start engine and check for fuel leaks.

THROTTLE BODY INJECTION UNIT SERVICE

Cleaning and Inspection

- All TBI component parts, with the exception of those noted below, should be cleaned in a cold immersion cleaner such as Carbon X (X-55) or equivalent.

NOTICE: The Throttle Position Sensor (TPS), Idle Air Control (IAC) valve, pressure regulator diaphragm assembly, fuel injector or other components containing rubber should not be placed in a solvent or cleaner bath. A chemical reaction will cause these parts to swell, harden, or distort. Do not soak the throttle body with the above parts attached. If the throttle body assembly requires cleaning, soaking time in the cleaner should be kept to a minimum. Some models have hidden throttle shaft dust seals that could lose their effectiveness by extended soaking.

1. Clean all metal parts thoroughly and blow dry with shop air. Be sure that all fuel and air passages are free of dirt or burrs.
2. Inspect mating casting surfaces for damage that could affect gasket sealing.
3. Check that throttle valve lever moves freely and smoothly.

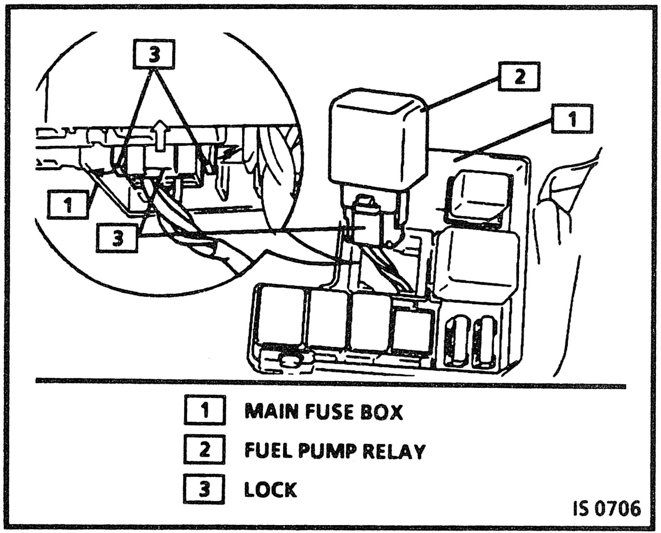

3
2
1
1
3
1 MAIN FUSE BOX
2 FUEL PUMP RELAY
3 LOCK
IS 0706

Figure C2-15 - Disconnecting Fuel Pump Relay

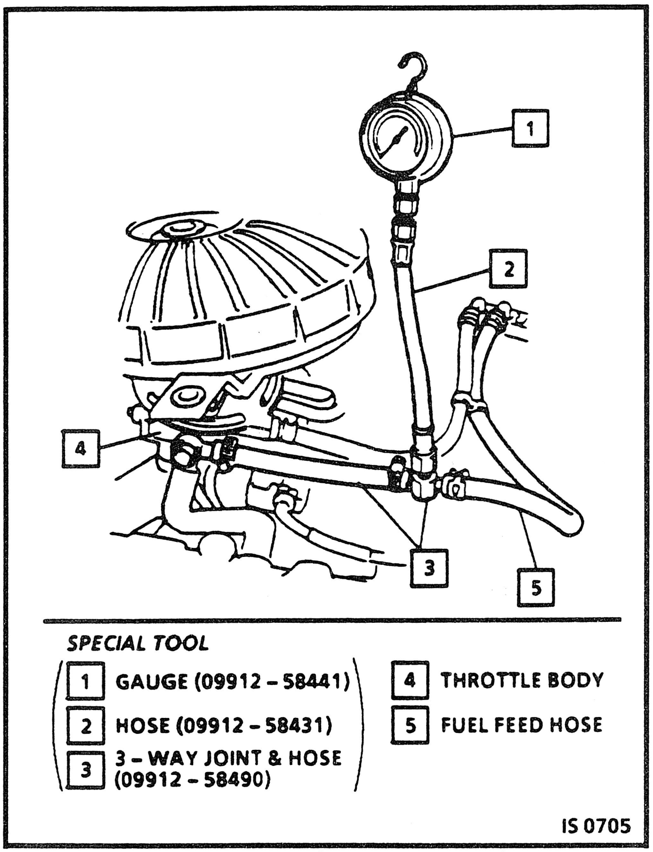

1
2
4
3
5
SPECIAL TOOL
1 GAUGE (09912 - 58441)
2 HOSE (09912 - 58431)
3 3 - WAY JOINT & HOSE (09912 - 58490)
4 THROTTLE BODY
5 FUEL FEED HOSE
IS 0705

Figure C2-16 - Fuel Gage Connection

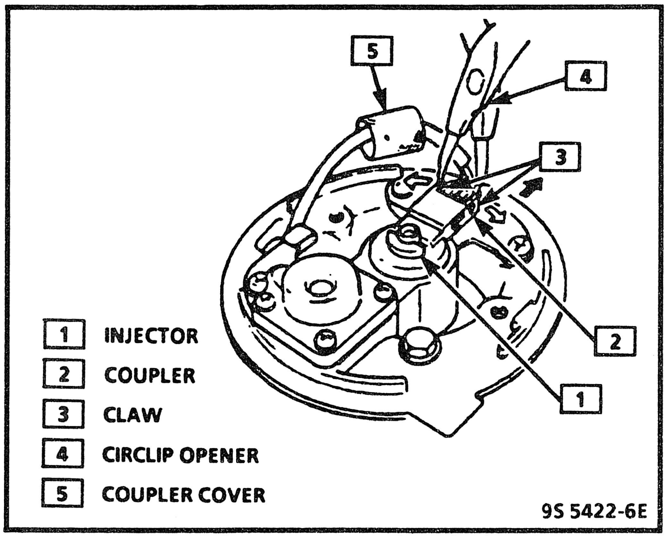

5
4
3
2
1
1 INJECTOR
2 COUPLER
3 CLAW
4 CIRCLIP OPENER
5 COUPLER COVER
9S 5422-6E

Figure C2-17 - Disconnecting Electrical Connector

FUEL INJECTOR

The fuel injector is serviced only as a complete assembly.

NOTICE: • Use care when opening claws on electrical coupler, as opening too far may cause damage.

- Use care when handling the injector, to prevent damage especially to the filter and the injector needle. Also, because the injector is an electrical component, it should not be immersed in any type of liquid solvent or cleaner, as damage may occur.

Remove or Disconnect (Figure C2-18)

1. Relieve fuel pressure using procedure in this section.
2. Negative battery cable.
3. Air cleaner assembly.
4. Air cleaner mounting bracket from throttle body.
5. Injector cover and upper insulator.
6. Electrical connector from injector, see Figure C2-17.
7. Fuel injector.

Inspect (Figure C2-18)

- Fuel injector filter for dirt or damage. If dirt is present check for dirt in fuel lines and fuel tank.

Important

- Be sure to replace injector with an identical part. Other injectors may appear to be the same, but they are calibrated differently for different flow rates.

Install or Connect (Figures C2-18, 19)

NOTICE: Never twist injector while installing as damage or misplacement of O-rings may occur.

1. Apply a thin coat of transmission oil or gasoline to the new upper and lower O-rings, install them on the injector.
2. New lower injector insulator in injector cavity.
3. Fuel injector
   - Push it straight into fuel injection cavity
4. New upper insulator and injector cover.

Tighten

- Injector cover screws to 3.5 N•m (31 lb. in.)

5. Injector electrical coupler to injector, facing it lug side upward on clamp subwire securely.
6. Battery negative cable.

Inspect

- With engine "OFF", and ignition "ON", check for fuel leaks.

7. Air cleaner mounting bracket.
8. Air cleaner assembly.

THROTTLE BODY ASSEMBLY

Remove or Disconnect (Figure C2-21)

1. Relieve fuel pressure following procedure in the section.
2. Negative battery cable.
3. Air cleaner assembly.
4. Drain cooling system.
5. The following electrical connectors:
   - Throttle Switch (M/T) or Throttle Position Sensor (A/T)
   - Fuel injector electrical connector
   - Coolant temperature sensor
6. The following at throttle body:
   - Fuel feed and return line hoses
   - Engine coolant hoses
   - Vacuum hoses
7. Accelerator cable.
8. Throttle body attaching bolts.

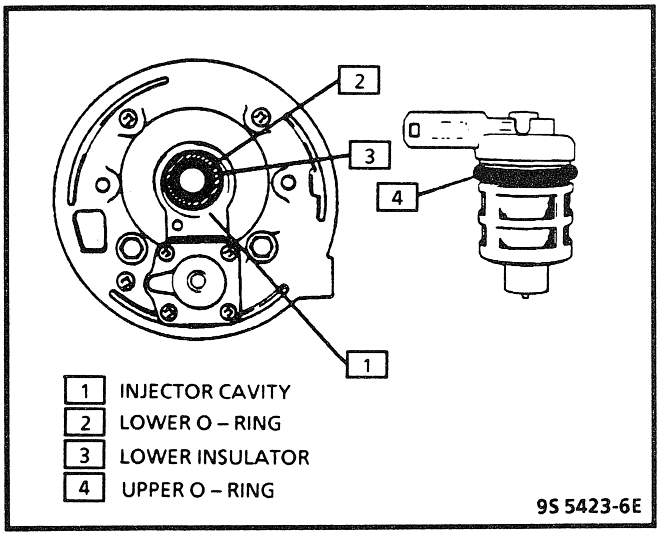


Figure C2-18 - Fuel Injector

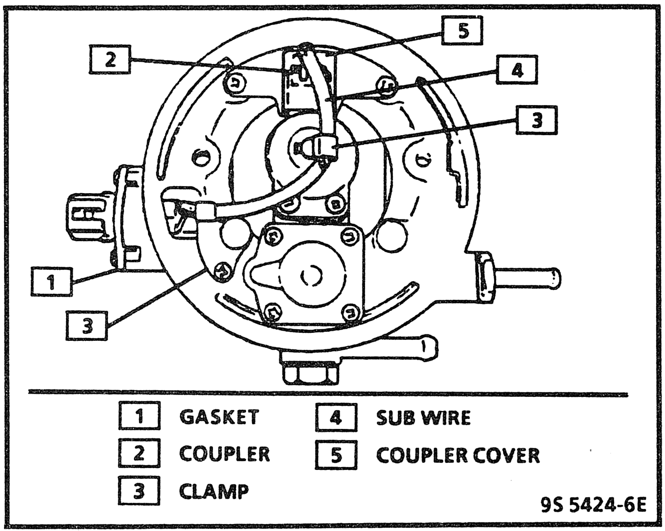
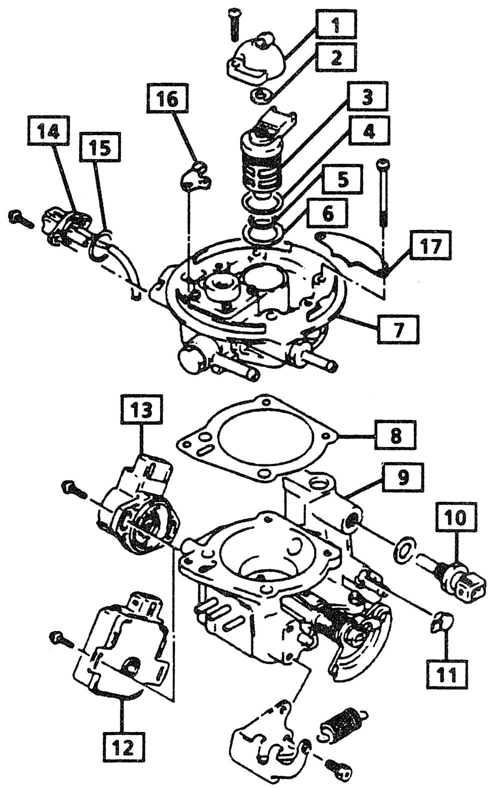


Figure C2-20 - Clamping Subwire



1	INJECTOR COVER
2	UPPER INSULATOR
3	FUEL INJECTOR
4	UPPER O-RING
5	LOWER O-RING
6	LOWER INSULATOR
7	THROTTLE UPPER BODY
8	GASKET
9	THROTTLE LOWER BODY
10	WTS
11	IDLE SPEED ADJUSTING SCREW CAP
12	TS (M/T MODEL ONLY)
13	TPS (A/T MODEL ONLY)
14	INJECTOR SUB WIRE COUPLER
15	O-RING
16	CLAMP
17	PLATE

IS 0716

Figure C2-20 - Throttle Body Injector Assembly

Important

- Be sure not to remove fuel pressure regulator or air valve from the throttle body. They are not serviceable. They are calibrated at the factory, and are not adjustable.

Disassemble (Figure C2-20)

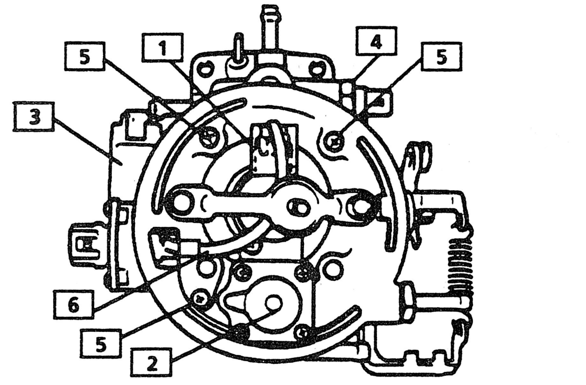
1. Fuel injector from throttle body, following procedure described in this section.
2. Throttle switch (M/T) or Throttle Position Sensor (A/T).
3. Coolant temperature sensor.
4. Upper TBI section attaching screws.
5. Separate upper and lower sections.

Clean

- Passages and fuel injector chamber with an air nozzle.

Important

- Throttle Switch (M/T) or TPS (A/T), fuel pressure regulator, injector, air valve, CTS, and other components containing rubber or throttle shaft seal must not be placed in solvents, or cleaner bath. Chemical reactions to these parts may result in damage to the component.



1	FUEL INJECTOR	3	TS OR TPS	5	SCREWS
2	FUEL PRESSURE REGULATOR	4	WTS	6	INJECTOR SUB WIRE

9S 5425-6E

Figure C2-21 - Throttle Body Disassembly

- Do not use drills, or wire brushes to clean air passage. Damage may result to the passage.

Assembly (Figure C2-21)

1. Install new lower gasket to throttle body.
2. Upper throttle body to lower half.
3. Upper TBI section attaching screws.

Tighten

- Attaching screws to 3.5 N•m (31 lb. in.).

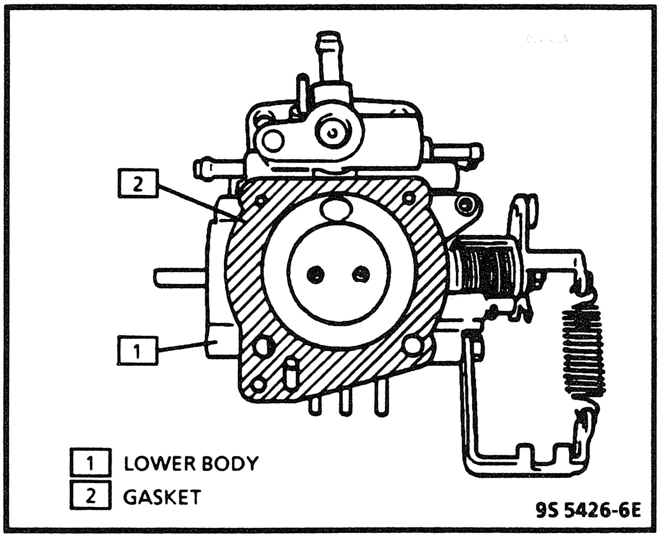


Figure C2-22 - Installing Gasket To Lower Throttle Body

4. Coolant temperature sensor.
5. Throttle Switch (M/T) or Throttle Position Sensor (A/T).
6. Fuel Injector.
7. Injector subwire and clamp securely.

Tighten

- Subwire connector screw to 2.0 N•m (18 lb. in.)

Install or Connect (Figure C2-23)

1. New throttle body to intake manifold gasket.
2. Throttle body to intake manifold.
3. Throttle body attaching bolts.

Tighten

- Throttle body attaching bolts to 23 N•m (17 lb. ft.)

4. Accelerator cable to throttle lever and bracket.
5. Fuel feed and return lines.
6. Coolant lines.
7. Vacuum Lines.
8. Throttle Switch (M/T) or Throttle Position Sensor (A/T).
9. Coolant temperature sensor.
10. Refill coolant system.
11. Negative battery cable.

Inspect

- With engine "OFF", ignition "ON", check for fuel leaks.

12. Air cleaner assembly.
13. Run engine and check for coolant and fuel leaks.

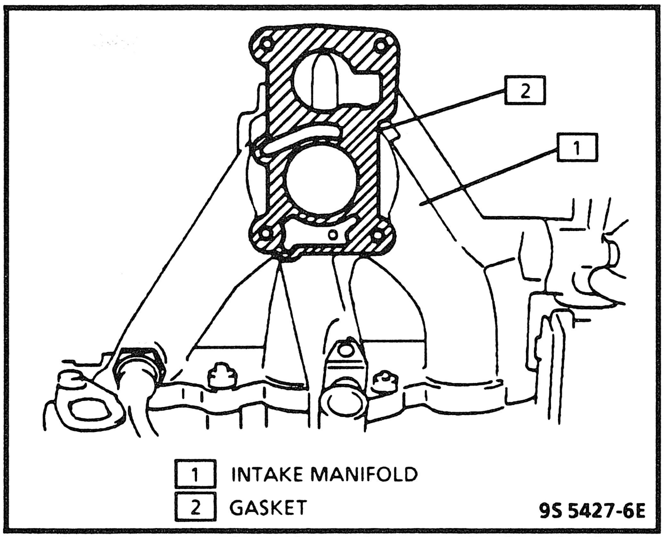


Figure C2-23 - Throttle Body to Intake (Gasket)

AIR VALVE CHECK

NOTICE: Use care to not submerse throttle body in water to prevent possible damage due to corrosion. Only the air valve should be submersed in the water.

Inspect (Figure C2-24)

1. Remove throttle body assembly as previously described in this section.
2. Separate the throttle body halves.
3. Remove coolant temperature sensor.
4. Immerse air valve in water.
5. Check that the valve closes as the water temperature rises, should fully close at 60°C (140°F). If it does not, replace the valve.
6. Install coolant temperature sensor.
7. Install upper and lower throttle body section, using a new gasket. Tighten attaching screws to 3.5 N·m (31 lb. in.).
8. Install throttle body with a new gasket. Tighten attaching bolts to 23 N·m (17 lb. ft.).

THROTTLE SWITCH (TS) (M/T Only)

NOTICE: The throttle switch is an electrical component and should not be immersed in any type of liquid solvent or cleaner as damage may occur.

Remove or Disconnect (Figure C2-25)

1. Negative battery cable.
2. Air cleaner assembly.
3. TS electrical connector.
4. Throttle switch.

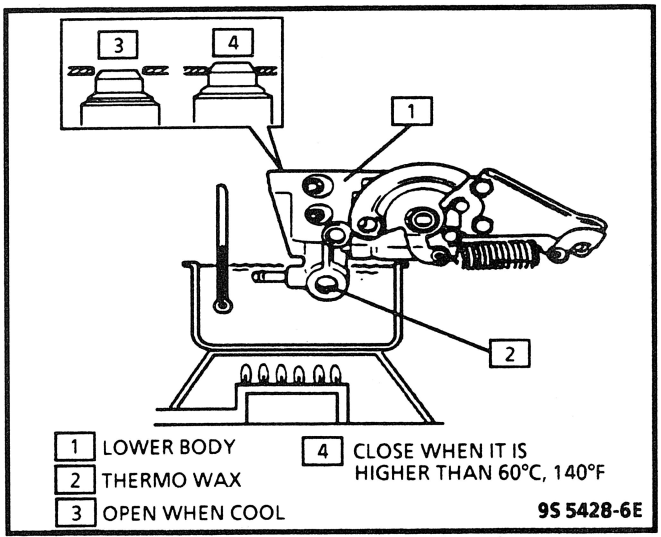

3
4
1
2
1 LOWER BODY
2 THERMO WAX
3 OPEN WHEN COOL
4 CLOSE WHEN IT IS HIGHER THAN 60°C, 140°F
9S 5428-6E

Figure C2-24 - Inspecting Air Valve

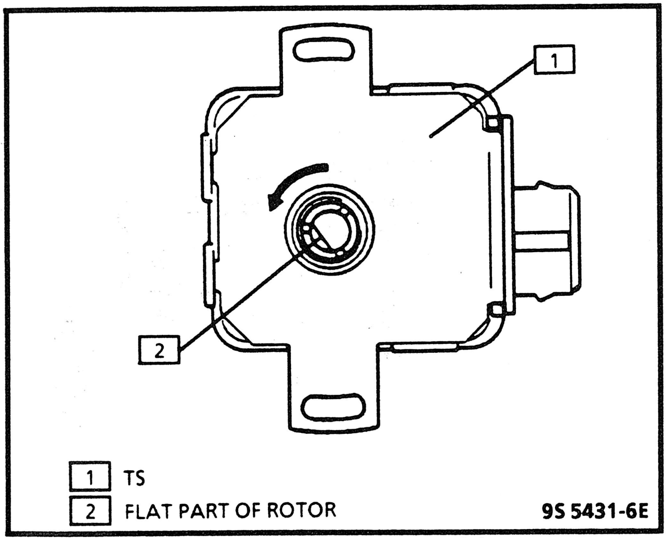

1
2
1 TS
2 FLAT PART OF ROTOR
9S 5431-6E

Figure C2-26 - TS Rotor Position

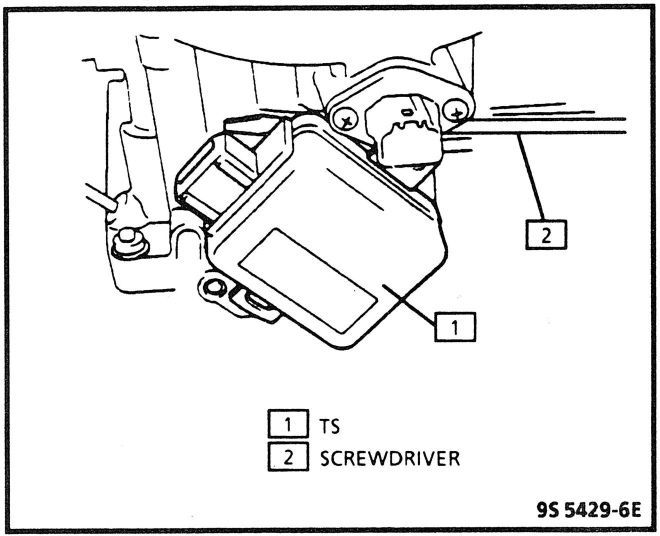

2
1
1 TS
2 SCREWDRIVER
9S 5429-6E

Figure C2-25 - Throttle Switch

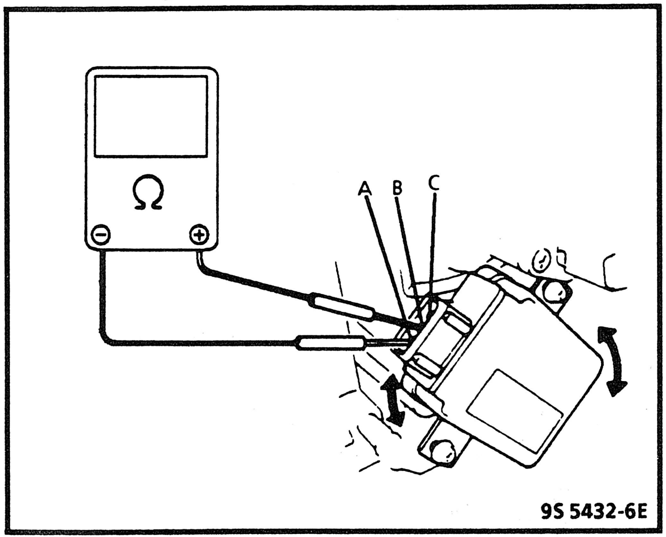

Ω
⊖
⊕
A
B
C
9S 5432-6E

Figure C2-27 - Adjustment Throttle Switch

Install or Connect (Figure C2-26)

1. Throttle switch to throttle body. Be sure the flat part of the rotor is positioned as shown. If not, rotate rotor counterclockwise until it stops.
2. Adjust TS.

Adjust (Figures C2-27, 28)

Important

- The throttle lever stop screw is not used to adjust throttle switch. It is set at the factory. Do not attempt to adjust throttle lever stop screw.

1. Insert .6 mm (.024") feeler gage between throttle lever stop screw and throttle lever.
2. Connect DVM between terminal "A" & "B" (Figure C2-28).
3. First, turn TS fully counterclockwise, then clockwise till DVM reads open (no continuity).
4. Tighten TS screws to 2.0 N•m (18 lb. in.).
5. Check that there is not continuity with a .9 mm (.035") feeler gage inserted between throttle lever stop screw and throttle lever.
6. Check that there is continuity with .3mm (.012") is inserted between throttle lever stop screw and throttle lever.
7. Connect TS electrical connector.
8. Install air cleaner assembly.

Throttle Switch Check (Figure C2-29)

1. Remove air cleaner assembly.
2. Disconnect TS electrical connector.
3. Insert feeler gage .3 mm (.01211) between throttle lever stop screw and throttle lever.
4. Connect DVM between terminals and check. If adjustment is needed follow procedure in this section.
5. Connect TS electrical connector.
6. Install air cleaner assembly.

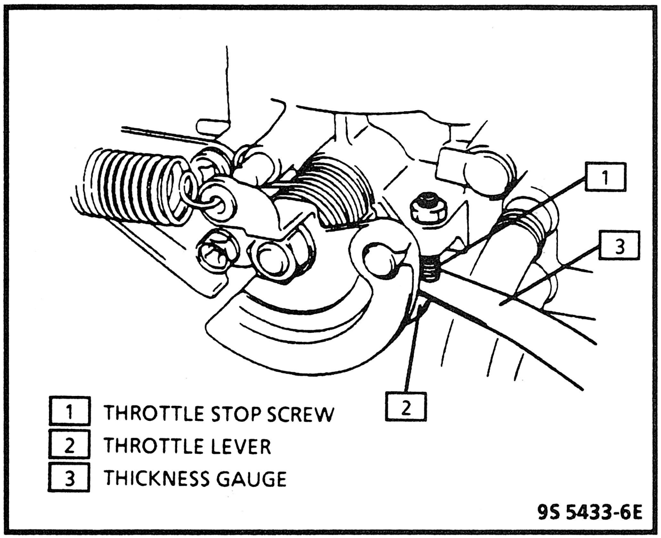

1 THROTTLE STOP SCREW
2 THROTTLE LEVER
3 THICKNESS GAUGE
9S 5433-6E

Figure C2-28 - Throttle Lever Stop Screw

CLEARANCE BETWEEN STOP SCREW AND LEVER	CONTINUITY BETWEEN TERMINALS		
	A and B (Idle Switch)	B and C (Wide Open Switch)	A and C
0.3 mm 0.012 in.	Continuity	NO Continuity	NO Continuity
0.9 mm 0.035 in.	NO Continuity	NO Continuity	NO Continuity
Throttle valve opened fully	NO Continuity	Continuity	NO Continuity

IS 0120

Figure C2-29 - TS Check

THROTTLE POSITION SENSOR (TPS) (A/T Only)

Remove or Disconnect (Figure C2-30)

1. Air cleaner assembly.
2. TPS connector.
3. 2 retaining screws for TPS.
4. TPS from throttle body.

Install or Connect (Figure C2-30)

1. TPS to throttle body.
2. Adjust TPS.

Adjust

1. Connect DVM to terminals "A" and "B".
2. Turn TPS fully counterclockwise, then clockwise till DVM reads zero (no continuity).
3. Check continuity between terminals "A" and "B" with a .9mm (.035") feeler gage inserted between throttle lever stop screw and throttle lever. DVM should read zero.
4. Repeat step above with a .3 mm (.012") feeler gauge. The DVM should read continuity.
5. Tighten retaining screws to 2.0 N•m (18 lb. in.).
6. Connect TPS electrical connector.
7. Install air cleaner assembly.

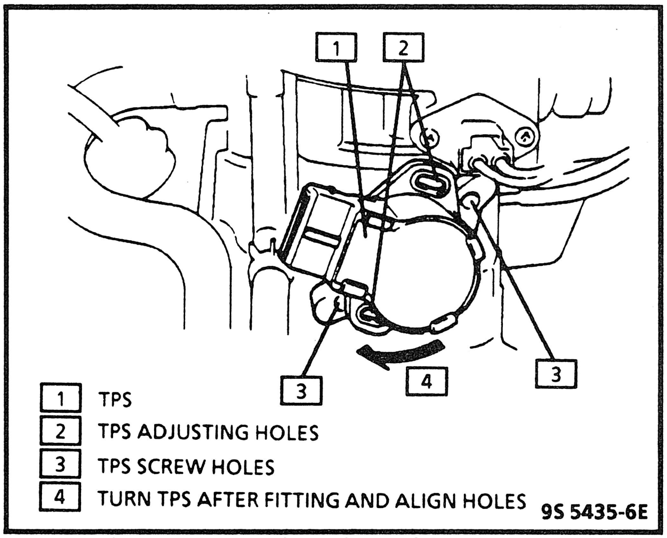

1 TPS
2 TPS ADJUSTING HOLES
3 TPS SCREW HOLES
4 TURN TPS AFTER FITTING AND ALIGN HOLES
9S 5435-6E

Figure C2-30 - Throttle Position Sensor

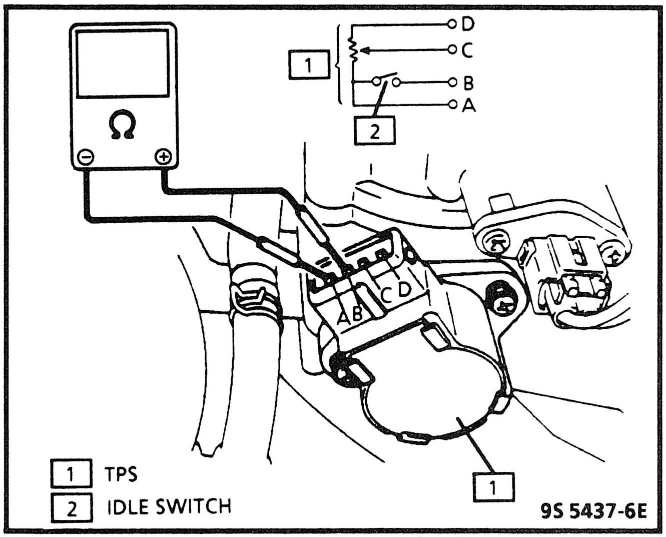

Ω
D
C
B
A
1 TPS
2 IDLE SWITCH
9S 5437-6E

Figure C2-31 - TPS Check

TERMINALS	CONDITION	RESISTANCE
Between A and B terminals (Idle Switch)	When throttle lever-to-stop screw clearance is 0.3 mm (0.012 in.)	0
	When throttle lever-to-stop screw clearance is 0.9 mm (0.035 in.)	Continuity
Between A and D terminals	Throttle valve is at idle position	4.37 - 8.13 k Ω
Between A and C terminals	Throttle valve is at idle position	240 - 1140 Ω
	Throttle valve is fully opened	3.17 - 6.6 k Ω

IS 0119

Figure C2-32 - TPS Output Check

Throttle Position Sensor Check (Figures C2-31, 32)

1. Remove air cleaner assembly.
2. Disconnect TPS electrical connector.
3. Using a DVM, check TPS output voltage.
4. Adjust or replace using procedures described in this section.
5. Install TPS electrical connector.
6. Install air cleaner assembly.

PARTS INFORMATION

Part Name	Group
Injector Kit, Fuel	3.300
Pump, Fuel (In-Tank)	3.900
Relay, Fuel Pump	3.900
Throttle Body Injection Unit	3.335
Throttle Switch (M/T)	3.320
Throttle Position Sensor (A/T)	3.339
Water Temperature Sensor	3.682
Air Temperature Sensor	3.682
Throttle Body Gasket (Intake)	3.336
Throttle Body Upper/Lower Gasket	3.336

TORQUE SPECIFICATIONS

Injector Cover Screws	3.5 N·m (31 lb.in.)
Upper TBI Sect Attach Screws	3.5 N·m (31 lb.in.)
Subwire Connector Screw	2.0 N·m (18 lb.in.)
Throttle Body Attach. Bolts	23 N·m (17 lb.ft.)
Throttle Switch Attach Screws	2.0 N·m (18 lb.in.)
TPS Attaching Screws	2.0 N·m (18 lb.in.)

SECTION C3

EVAPORATIVE EMISSION CONTROL SYSTEM (EECS)

CONTENTS

GENERAL DESCRIPTION C3-1
PURPOSE C3-1
EVAPORATIVE EMISSION CONTROL SYSTEM C3-1
RESULTS OF INCORRECT OPERATION ... C3-1
ON-VEHICLE SERVICE C3-2
CHARCOAL CANISTER REPLACEMENT .. C3-2
CANISTER HOSES C3-2
CANISTER COMPONENT CHECK C3-2
CANISTER VALVE CHECK C3-2
BI-METAL VACUUM SWITCHING VALVE (BVSV) CHECK C3-3
BVSV REPLACEMENT C3-3
2-WAY CHECK VALVE CHECK C3-3
PARTS INFORMATION C3-3

GENERAL DESCRIPTION

PURPOSE

The basic Evaporative Emission Control System (EECS) used on all vehicles is the charcoal canister storage method. This method transfers fuel vapor from the fuel tank to an activated carbon (charcoal) storage device (canister) to hold the vapors when the vehicle is not operating. When the engine is running, the fuel vapor is purged from the carbon element by intake air flow and consumed in the normal combustion process.

EVAPORATIVE EMISSION CONTROL SYSTEM (Figure C3-1)

An evaporative emission control system is used to prevent emission of fuel vapor.

The vapor generated in the fuel tank while driving or the engine at a stop passes through a 2-way check valve and enters the charcoal canister where the charcoal absorbs and stores the fuel vapor.

Only when the following conditions are all satisfied, ported vacuum is applied to canister purge control valve and the valve opens.

- Engine is running.
- Engine coolant temperature is high. (Engine is warmed up.)
- Throttle valve opens larger than idle position.

As a result, fuel vapor in the canister is sucked into intake manifold through purge control valve and purge line.

In this state, the canister is purged or cleaned by air drawn through the filter at the bottom of the canister.

When engine coolant water temperature is low, the vacuum signal line communicates with atmosphere through Bimetal Vacuum Switching Valve (BVSV).

Therefore, ported vacuum is not applied to purge control valve, and the valve is closed. In this state, the canister is not purged.

The 2-way check valve is provided to keep the pressure in the fuel tank constant. When the pressure in the fuel tank becomes positive and reaches its specified value, it opens the valve to let the vapor flow into the charcoal canister. On the other hand, when the pressure in the fuel tank becomes negative and reaches its specified value, it opens the valve to let the air flow into the fuel tank.

RESULTS OF INCORRECT OPERATION

Poor idle, stalling and poor driveability can be caused by:

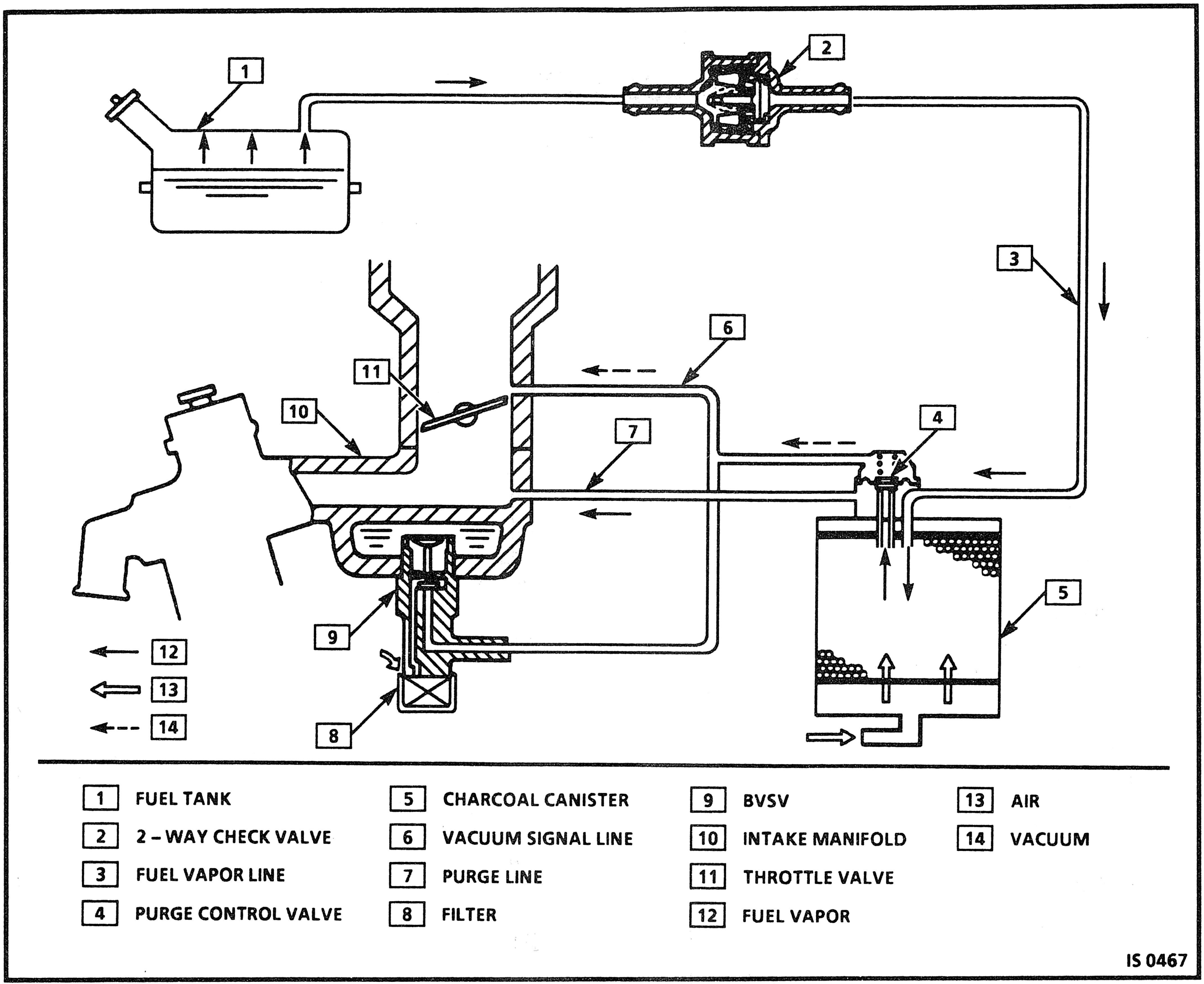
- Inoperative purge solenoid
- Damaged canister
- Hoses split, cracked and, or not connected to the proper tubes.

Evidence of fuel loss or fuel vapor odor can be caused by:

- Liquid fuel leaking from fuel lines, or fuel pump
- Cracked or damaged canister
- Disconnected, misrouted, kinked, deteriorated or damaged vapor hoses, or control hoses.

If the solenoid is open, the canister can purge to the intake manifold at all times. This can allow extra fuel at idle or during warm-up, which can cause rough or unstable idle, or too rich operation.

If the solenoid is closed the canister can become over loaded resulting odor.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7
8
9
10
11
12
13
14
1 FUEL TANK
2 2 - WAY CHECK VALVE
3 FUEL VAPOR LINE
4 PURGE CONTROL VALVE
5 CHARCOAL CANISTER
6 VACUUM SIGNAL LINE
7 PURGE LINE
8 FILTER
9 BVSV
10 INTAKE MANIFOLD
11 THROTTLE VALVE
12 FUEL VAPOR
13 AIR
14 VACUUM
IS 0467

Figure C3-1 - Evaporative Emission Control System

ON-VEHICLE SERVICE

Important

- A careful visual check of canister and the connecting vacuum hose should be made before diagnosis of canister problem.

CHARCOAL CANISTER REPLACEMENT

Remove or Disconnect

1. Vacuum hoses from canister.
2. Bracket and canister from cowl.

Install or Connect

1. Canister and bracket to cowl.
2. Vacuum hoses.

CANISTER HOSES

Refer to Vehicle Emissions Control Information Label for routing of canister hose.

CANISTER COMPONENT CHECK

CAUTION: **Do not suck on canister valve. Fuel vapor inside canister is harmful.**

CANISTER VALVE CHECK

With fuel canister removed, the following checks will determine if the valve located on top of canister is operating properly.

1. Using small length of vacuum hose connected to tank tube, (Figure C3-2) blow into canister. Air should escape the air tube at bottom of canister.

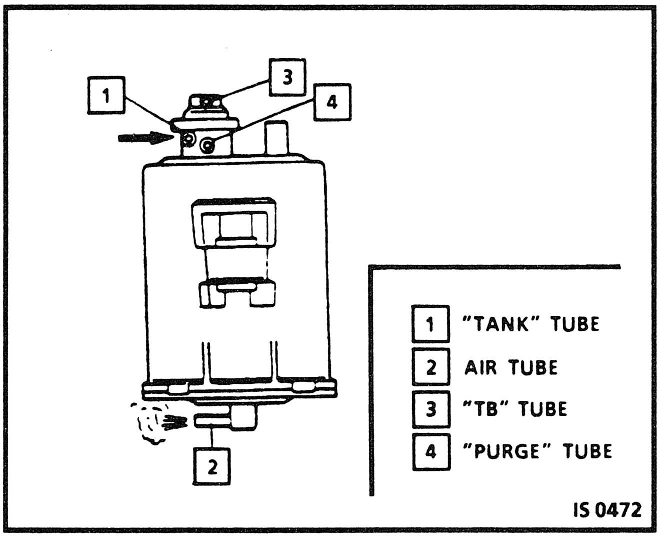

Figure C3-2 - Canister Valve

2. Using same procedure above with hose connected to the purge tube, "NO" air should pass through the canister valve.
3. Apply 20" of vacuum to vacuum signal line tube of canister valve, while blowing air into purge tube, air should come out of the TB tube.

If operation differs from above check, canister should be replaced.

If canister valve fails the above test the canister should be replaced

BI-METAL VACUUM SWITCHING VALVE (BVSV) CHECK (Figure C3-3)

1. Remove vacuum hoses.
2. Connect a length of vacuum hose to valve with engine cold.
3. Blow into valve, air should pass through valve.
4. Start engine, run until normal operating temperature is obtained 60°C (140°F).
5. Blow into valve, air should not pass through valve.
6. If valve fails the above test, replace valve using the procedures in this section. If valve passes the above test reinstall vacuum hoses.

BVSV REPLACEMENT

Remove or Disconnect

1. Vacuum hose at BVSV.
2. Drain engine coolant.
3. Idle Speed Control (ISC) solenoid valve bracket from intake manifold.
4. BVSV from intake manifold.

Install or Connect

1. Apply teflon tape to valve threads.
2. Valve.
3. ISC solenoid valve bracket to intake.

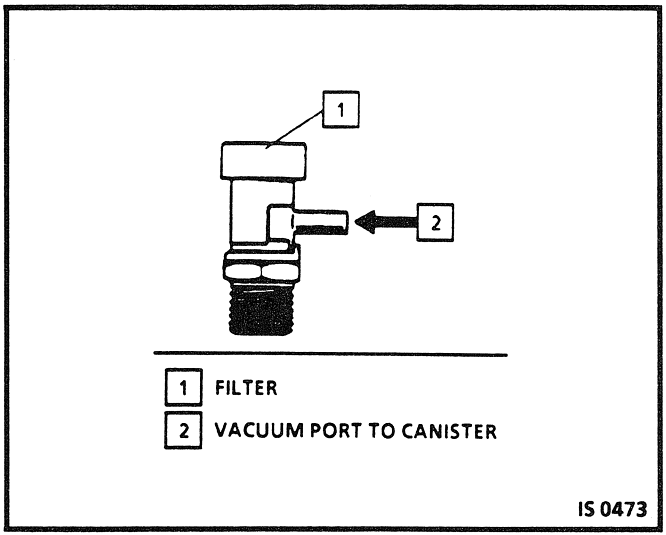

Figure C3-3 - Bi-Metal Vacuum Switching Valve (BVSV)

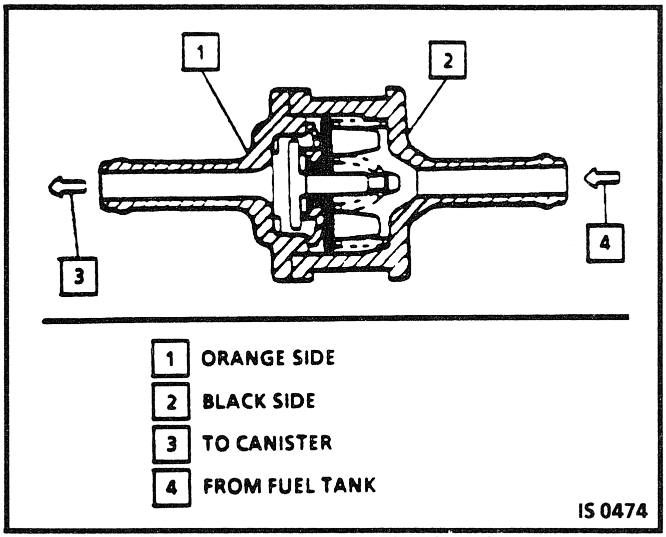

Figure C3-4 - 2-Way Check Valve

4. Vacuum hose to valve.
5. Refill engine coolant to proper level.

2-WAY CHECK VALVE CHECK (Figure C3-4)

1. Remove 2-way check valve.
2. Blow hard into back side of valve, air should pass through valve.
3. Blow lightly into orange side of valve, air should pass through. If 2-way check valve does not function as above replace valve.

PARTS INFORMATION

PART NAME	GROUP
Canister	3.130
Bimetal VSV	3.670

SECTION C4

IGNITION SYSTEM

CONTENTS

GENERAL DESCRIPTION C4-1
CONVENTIONAL SOLID STATE IGNITION SYSTEM (METRO LSI WITH VACUUM ADVANCE ON DISTRIBUTOR) C4-1
ESA IGNITION SYSTEM (METRO WITHOUT VACUUM ADVANCE ON DISTRIBUTOR) C4-1
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Replacement C4-3
Centrifugal Advance Check C4-4
Vacuum Advance Check C4-4
Vacuum Advance Replacements C4-4
Pick-Up Coil Replacement C4-4
DISTRIBUTOR ESA (Without Vacuum Advance) C4-5
Replacement C4-5
Centrifugal Advance Check C4-5
Crank Angle Sensor Air Gap Check .. C4-5
Air Gap Adjustment C4-5
PARTS INFORMATION C4-6

GENERAL DESCRIPTION

This car uses two types of ignition systems: one is a conventional type solid state ignition system which is used for Metro LS Model M/T model and A/T model and the other is an Electronic Spark Advance (ESA) system which is used for the METRO model.

CONVENTIONAL SOLID STATE IGNITION SYSTEM (METRO LSI WITH VACUUM ADVANCE ON DISTRIBUTOR) (Figure C4-1)

The basic components of the ignition system are ignition coil, distributor and spark plugs and those of the distributor are signal generator (signal rotor and pickup coil), igniter, rotor, vacuum advancer and centrifugal advancer.

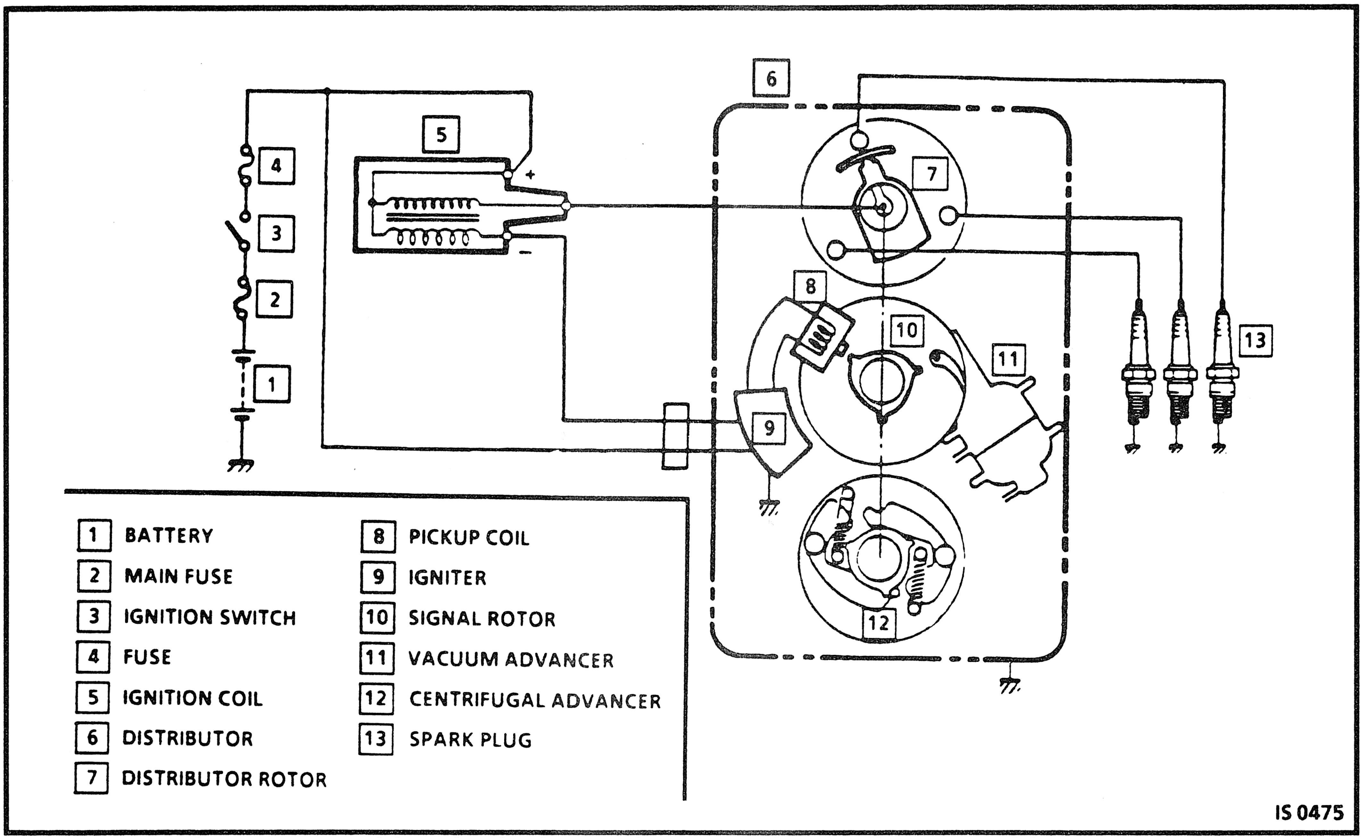
When the distributor shaft rotates, the magnetic flux passing through the pickup coil varies due to the change in air gap between the pickup coil and the signal rotor. As a result, an alternating current voltage is induced in the pickup coil.

The voltage induced, turns the igniter "ON" and "OFF" which in turn, switches the ignition coil primary current "ON" and "OFF." Thus, high voltage is induced into the secondary winding of ignition coil and ignition voltage is supplied to the spark plugs.

The spark advance is produced by the vacuum advance which operates based on the engine vacuum and centrifugal advance.

ESA IGNITION SYSTEM (METRO WITHOUT VACUUM ADVANCE ON DISTRIBUTOR) (Figure C4-2)

In the ESA system, the ECM is programmed for the best ignition timing under every engine condition. After receiving signals indicating the engine status (e.g. engine revolutions, manifold vacuum, coolant temperature, etc.) it selects the most suitable ignition timing from its memory. The ECM controls a driver to ground within the ECM. This causes the coils primary circuit to be low or "OFF", thus high voltage is induced in the secondary windings of the coil. Voltage is then supplied to the spark plugs. Thus ignition timing is controlled to yield the best engine performance.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13
+
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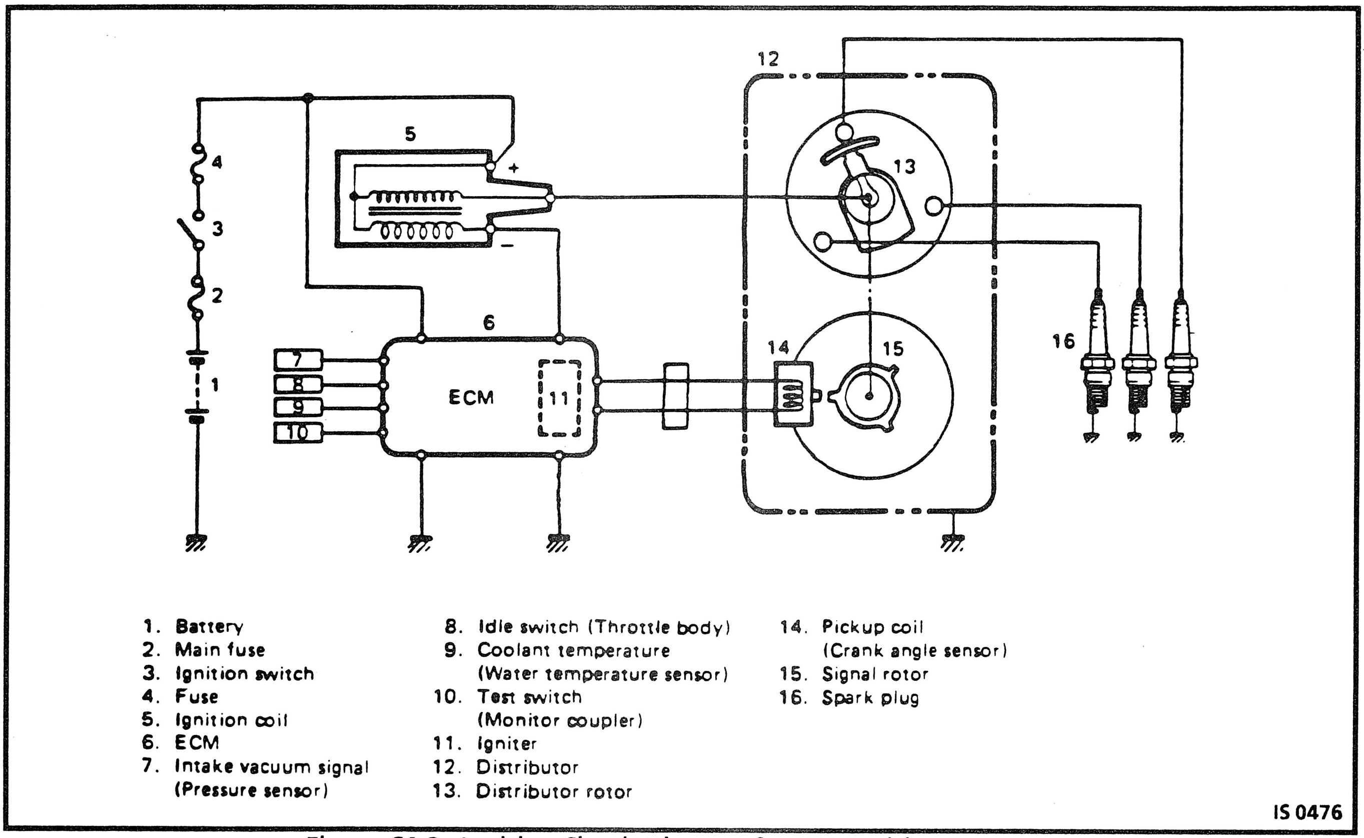
1 BATTERY
2 MAIN FUSE
3 IGNITION SWITCH
4 FUSE
5 IGNITION COIL
6 DISTRIBUTOR
7 DISTRIBUTOR ROTOR
8 PICKUP COIL
9 IGNITER
10 SIGNAL ROTOR
11 VACUUM ADVANCER
12 CENTRIFUGAL ADVANCER
13 SPARK PLUG
IS 0475

Figure C4-1 - Ignition Circuit Diagram for Conventional Solid State Ignition System (Metro LSI With Vacuum Advance)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16
+
−
ECM
1. Battery
2. Main fuse
3. Ignition switch
4. Fuse
5. Ignition coil
6. ECM
7. Intake vacuum signal (Pressure sensor)
8. Idle switch (Throttle body)
9. Coolant temperature (Water temperature sensor)
10. Test switch (Monitor coupler)
11. Igniter
12. Distributor
13. Distributor rotor
14. Pickup coil (Crank angle sensor)
15. Signal rotor
16. Spark plug
IS 0476

Figure C4-2 - Ignition Circuit Diagram for ESA Ignition System (Metro Without Vacuum Advance)

ON-VEHICLE SERVICE

IGNITION COIL REPLACEMENT (Figure C4-3)

Remove or Disconnect

1. Plastic cover over coil electrical terminals.
2. Negative battery cable.
3. High tension wire from coil.
4. Power and ground wires from coil.
5. Coil and bracket from cowl.

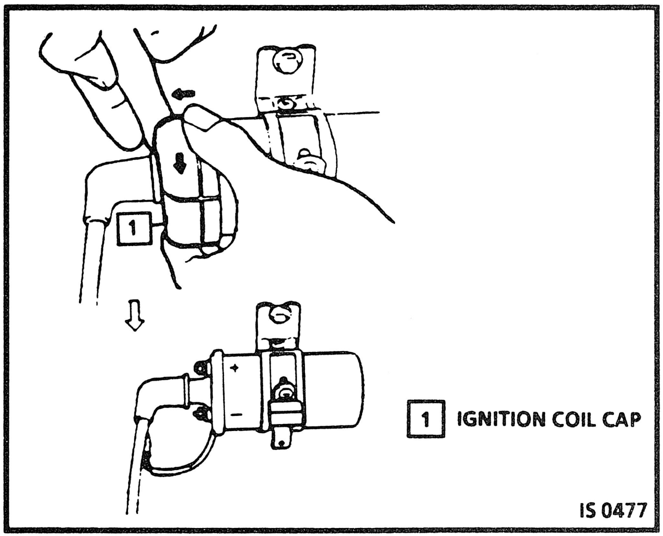

1
1 IGNITION COIL CAP
IS 0477

Figure C4-3 - Ignition Coil

Disassemble

- Coil from bracket

Assemble

- New coil to bracket

Install or Connect

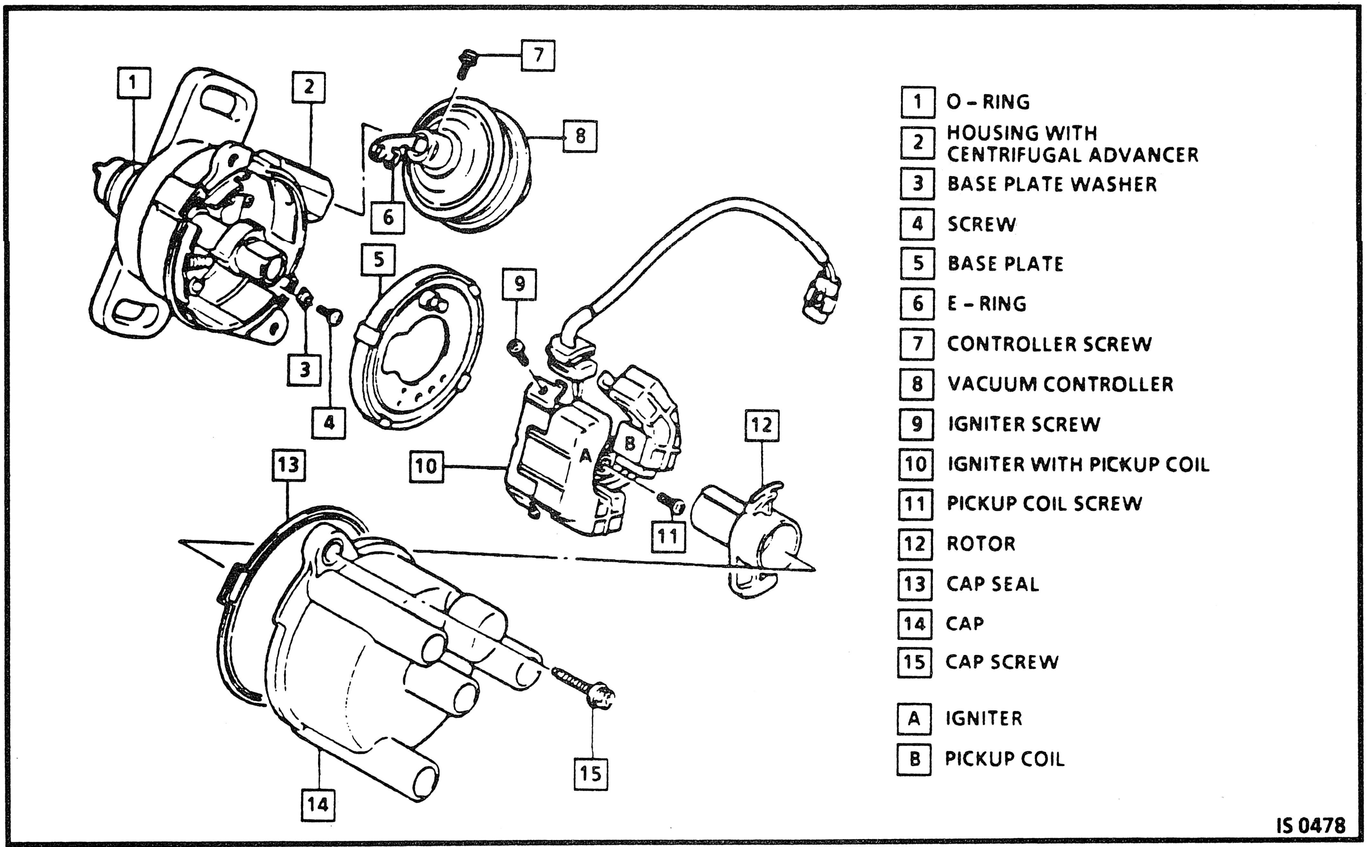
1. Coil and bracket to cowl.
2. Power and ground wires to coil.
3. Cover to coil electrical connectors.
4. High tension wire to coil.

DISTRIBUTOR (Conventional Type With Vacuum Advance) (Figure C4-4)

Replacement

Remove or Disconnect

1. Distributor electrical connector.
2. Spark plug (3) wires and coil wire.
3. Vacuum hoses at advance unit.
4. Distributor fastener.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14
15
A
B
1 O - RING
2 HOUSING WITH CENTRIFUGAL ADVANCER
3 BASE PLATE WASHER
4 SCREW
5 BASE PLATE
6 E - RING
7 CONTROLLER SCREW
8 VACUUM CONTROLLER
9 IGNITER SCREW
10 IGNITER WITH PICKUP COIL
11 PICKUP COIL SCREW
12 ROTOR
13 CAP SEAL
14 CAP
15 CAP SCREW
A IGNITER
B PICKUP COIL
IS 0478

Figure C4-4 - Conventional Solid State Distributor Components

Install or Connect

Important

- Crankshaft should be at top dead center on #1 cylinder when reinstalling distributor.

1. Distributor into cylinder head, set on #1 cylinder, timing light connected to #1 cylinder spark plug wire.
2. Retainer bolt, finger tighten only.
3. Distributor cap and spark plug (3) wires and coil wire.
4. Distributor electrical connector.

Adjust

1. Engine at normal operating temperature, above 60°C (140°F).
2. Vacuum advance disconnected and plugged.
3. Set timing:
   - M/T - 6° ± 1° BTDC
   - A/T - 6° ± 1° BTDC

   Check with vacuum advance reconnected:
   - M/T - 12° ± 1° BTDC
   - A/T - 12° ± 1° BTDC

Tighten

- Retaining bolt to 14 N·m (19 lb. ft.)

Centrifugal Advance Check (Figure C4-5)

1. Remove distributor cap.
2. Rotate rotor counter-clockwise.
3. Release rotor, it should spring back.
4. Replace distributor if centrifugal advance fails this check. Refer to distributor replacement in this section.

Vacuum Advance Check (Figure C4-6)

1. Remove distributor cap.
2. Disconnect vacuum hoses.
3. Connect a vacuum pump to outside vacuum tube. Apply 15" of vacuum to advance.
4. Pick-up coil should move.
5. Repeat step 3 to inside vacuum tube.

Vacuum Advance Replacements

Remove or Disconnect

1. Distributor cap.
2. Vacuum hoses at advance.
3. Fastener on side of vacuum advance.
4. C-Clip on vacuum advancer arm.
5. Vacuum advance.

Install or Connect

1. Vacuum advance.
2. C-Clip on vacuum advancer arm.
3. Fastener on side of vacuum advance.
4. Vacuum hoses at advance.
5. Distributor cap.

Pick-Up Coil Replacement (Figure C4-7)

Remove or Disconnect

1. Distributor.
2. Vacuum advance.
3. Pick-up coil attaching screws (2).

Install or Connect

1. Install pick-up coil.
2. Pick-up coil attaching screws (2).
   - Finger tighten only.

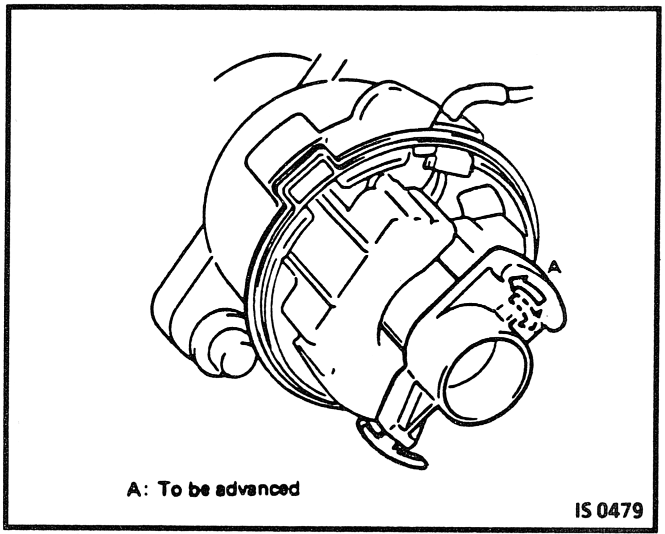

Figure C4-5 - Checking Centrifugal Advancer

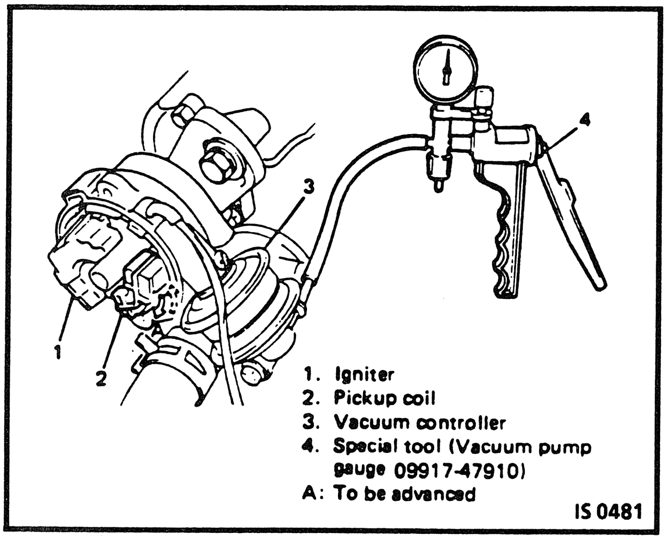

Figure C4-6 - Checking Vacuum Advance

Adjust

- Adjust air gap 0.2mm - 0.4mm (.008" - .016") use non-metallic feeler gage. Tighten pick-up coil attaching screws (2).

3. Distributor.

Adjust

- Timing according to procedures on underhood Vehicle Emission Control Information Label.

DISTRIBUTOR ESA (Without Vacuum Advance)

Replacement

Remove or Disconnect

1. Distributor electrical connector.
2. Distributor cap and spark plug wires.
3. Retaining bolt.

Install or Connect

Important

- Crankshaft should be aligned at top dead center.

1. Align timing mark to top dead center for #1 cylinder compression stroke.
2. Align slot on distributor base with slot on drive gear of distributor shaft.
3. Distributor into cylinder head.
   - Finger tighten retaining bolt.
4. Distributor electrical connector.
5. Distributor rotor, cap and spark plug wires (3).

Adjust

- Timing, according to procedures on underhood Vehicle Emission Control Information Label.

Centrifugal Advance Check (Figure C4-5)

1. Remove distributor cap.
2. Rotate rotor counter-clockwise and release. Rotor will return to original position.
3. If centrifugal advance is stuck or slow to return, replace distributor. Refer to procedure in this section.

Crank Angle Sensor Air Gap Check (Figure C4-8)

Measure

1. Remove distributor cap and rotor.
2. Disconnect electrical connector.
3. Rotate crankshaft to align signal rotor with sensor (Figure C4-8).
4. Measure air gap using non-metallic feeler gage: .2 - .4mm (.008 - .016 in.)

Air Gap Adjustment

Important

- If air gap cannot be set replace distributor. Refer to procedure in this section.

Adjust

1. Loosen two retaining screws.
2. Adjust air gap to proper setting.
3. Tighten two retaining screws and recheck.
4. Install rotor and distributor cap.
5. Reconnect electrical connector.

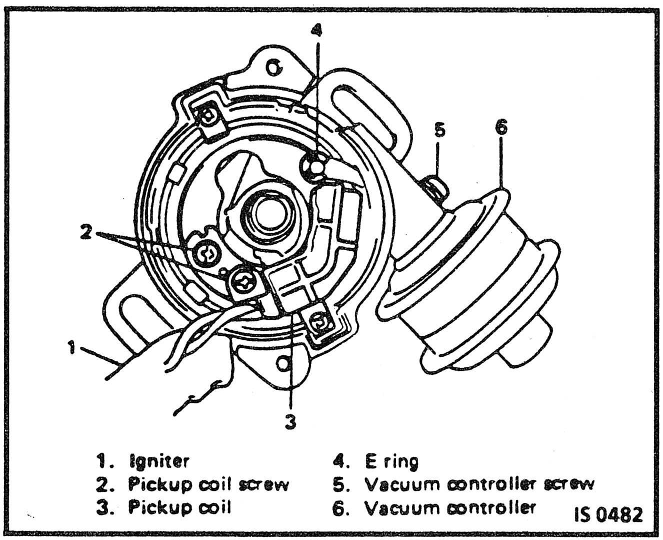

Figure C4-7 - Removing Pickup Coil

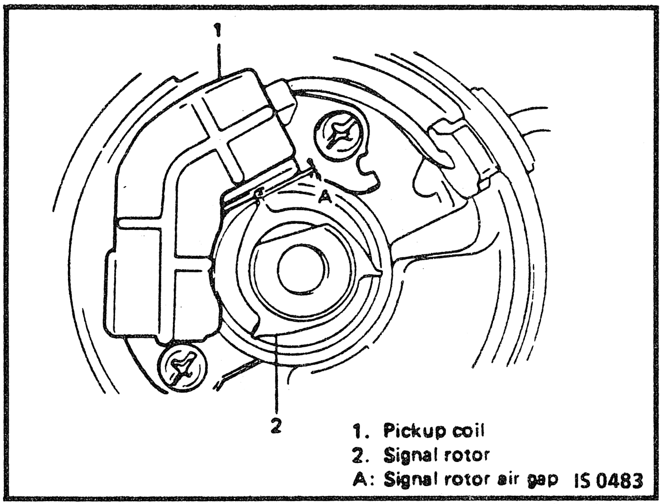

Figure C4-8 - Crank Angle Sensor Air Gap Check

PARTS INFORMATION

PART NAME	GROUP
Distributor	2.361
Ignition Coil	2.170
Noise Suppressor	9.663
Distributor Cap	2.367
Rotor	2.382
Vacuum Advance	2.410
Crank Angle Assembly	2.383
Pick-Up Coil	2.383
Spark Plug Wires	2.240
Spark Plugs	2.270

SECTION C7

EXHAUST GAS RECIRCULATION (EGR) SYSTEM
(FOR ALL CALIFORNIA EMISSIONS AND ONLY ESA MODEL FEDERAL EMISSIONS SYSTEMS)

CONTENTS

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  EGR VALVE CHECK C7-1
  EGR MODULATOR CHECK C7-2
  EGR VACUUM SWITCH VALVE SOLENOID CHECK C7-3
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EGR MODULATOR REPLACEMENT C7-3
EGR VACUUM SWITCHING VALVE REPLACEMENT C7-3
PARTS INFORMATION C7-3

GENERAL DESCRIPTION

The EGR System controls the formation of NOx (Oxides of Nitrogen) Emissions by recirculating the exhaust gases into the combustion chamber. This is done through the intake manifold.

OPERATION
(Figure C7-1)

The EGR is controlled by the ECM through an EGR vacuum switching valve and modulator. Vacuum is allowed to the EGR Valve at acceleration and shut "OFF" upon deceleration or constant engine speed.

The diaphragm mounted in the EGR modulator is operated by back pressure of the exhaust gas to open and close the valve. By this opening and closing action of the valve, the EGR modulator controls the vacuum transmitted to the EGR valve.

Under a low load condition such as low speed driving, the exhaust pressure is low. In this state, the diaphragm in the EGR modulator is pushed down by the spring force and the modulator valve opens to allow the air into the vacuum passage from the outside.

As a result, the vacuum transmitted to the EGR valve becomes smaller and so does the opening of the EGR valve.

Thus, less amount of exhaust gas is recirculated to the intake manifold.

Under a high load condition such as high speed driving, on the other hand, the exhaust pressure is high. By the high exhaust pressure, the diaphragm in the modulator is pushed up and closes its valve. As the air does not enter the vacuum passage in this state, the vacuum transmitted to the EGR valve grows larger and so does the opening of the EGR valve.

Thus, larger amount of exhaust gas is recirculated to the intake manifold.

Under any one of the following conditions, ECM closes the vacuum passage of VSV. In this state, as the vacuum is not transmitted to the EGR valve, it remains closed.

- When engine coolant temperature is low.
- When throttle valve is at idle position.
- When engine is running under high load.
- When intake manifold pressure is low.

Other than the above, EGR valve opens and closes in accordance with the EGR modulator operation.

EGR VALVE CHECK

1. Engine operating a normal temperature 60°C (120°F).
2. Place finger on EGR valve diaphragm and accelerate engine, diaphragm should move.
3. If diaphragm doesn't move see CHART C-7.
4. Disconnect vacuum hose from EGR valve.
5. Apply 10" inches of vacuum using a vacuum pump to valve with finger on diaphragm. It should move and engine may stall.
6. If valve passes the above test use Code Chart 51. If valve fails, replace valve.

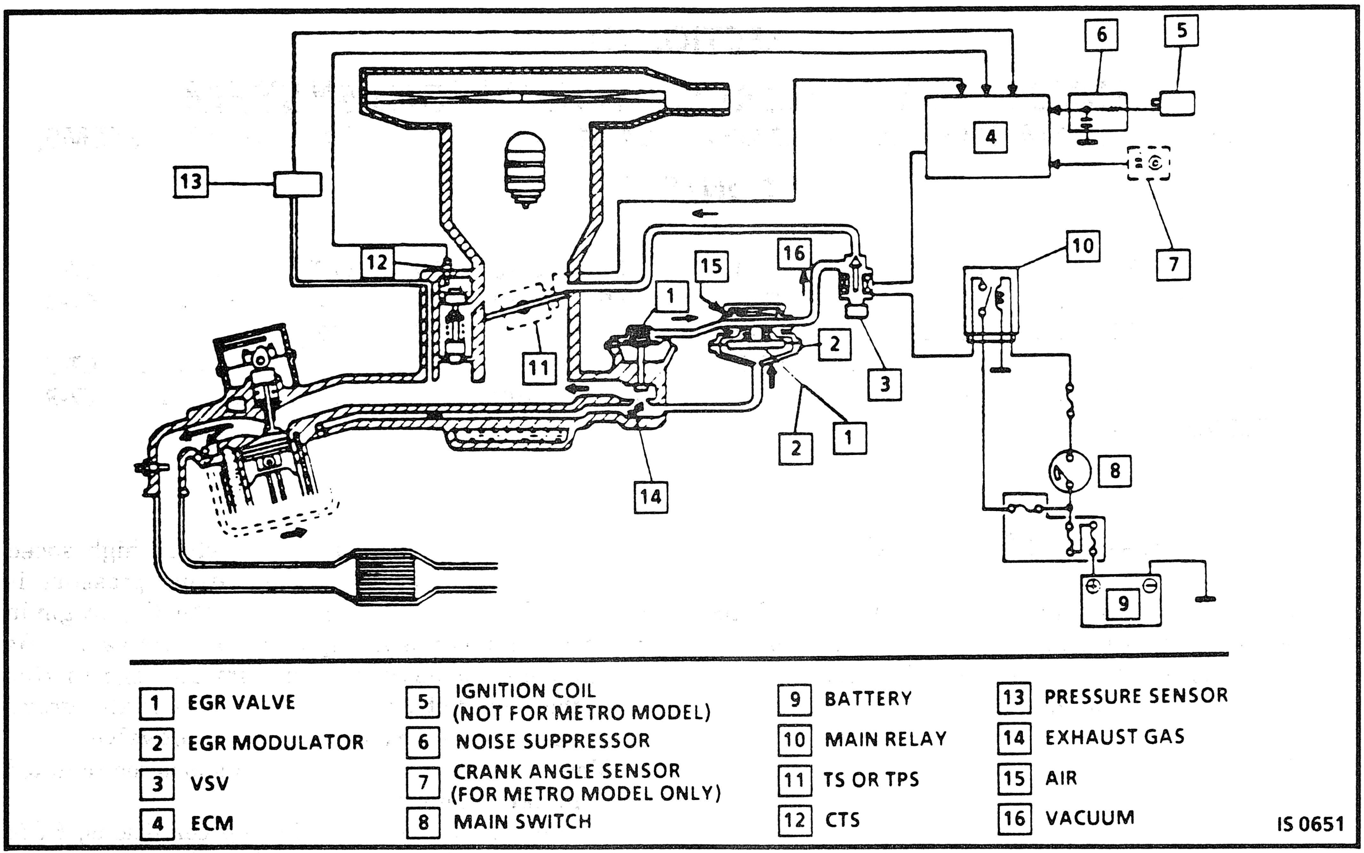

6
5
4
13
7
10
12
16
15
1
2
3
11
8
14
9
1 EGR VALVE
2 EGR MODULATOR
3 VSV
4 ECM
5 IGNITION COIL (NOT FOR METRO MODEL)
6 NOISE SUPPRESSOR
7 CRANK ANGLE SENSOR (FOR METRO MODEL ONLY)
8 MAIN SWITCH
9 BATTERY
10 MAIN RELAY
11 TS OR TPS
12 CTS
13 PRESSURE SENSOR
14 EXHAUST GAS
15 AIR
16 VACUUM
IS 0651

Figure C7-1 - EGR System & Components

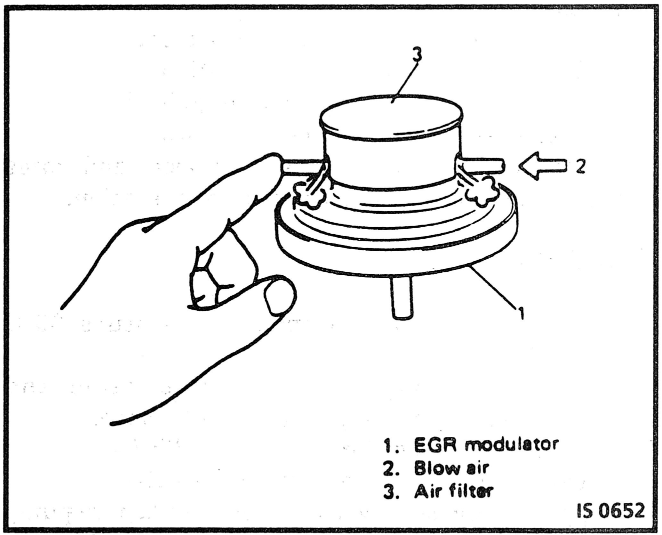

3
2
1
1. EGR modulator
2. Blow air
3. Air filter
IS 0652

Figure C7-2 - Modulator Check (1)

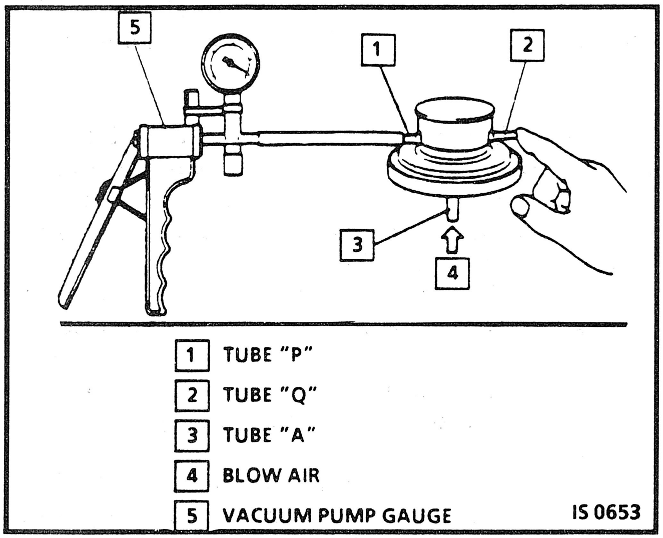

5
1
2
3
4
1 TUBE "P"
2 TUBE "Q"
3 TUBE "A"
4 BLOW AIR
5 VACUUM PUMP GAUGE
IS 0653

Figure C7-3 - Modulator Check (2)

EGR MODULATOR CHECK

1. Remove vacuum hoses (3) from modulator.
2. Place finger over modulator tube and blow in opposite tube (Figure C7-2). Air should pass through filter part of modulator.
3. Connect vacuum pump to tube "P" and plug tube "Q" with your finger.
4. Blow air into Tube "A". Should not be able to obtain vacuum on pump (Figure C7-3).
5. If EGR modulator fails this test, replace modulator.

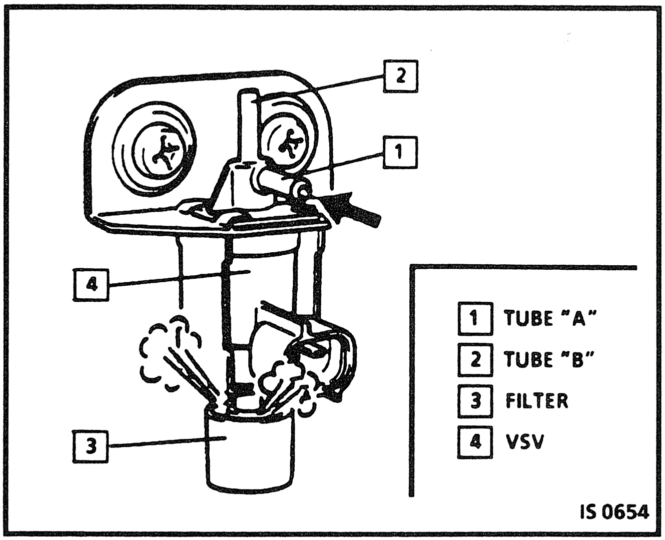


Figure C7-4 - VSV Solenoid Vacuum Check

EGR VACUUM SWITCH VALVE SOLENOID CHECK

1. Disconnect vacuum hoses (2) from solenoid.
2. Disconnect electrical connector with ignition "OFF".
3. Using DVM check resistance between two terminals.
4. You should have 33 - 39 ohms of resistance. If resistance is within specification proceed to step 5. If not, replace solenoid.
5. Blow into tube "A", air should exhaust through filter, not tube "B" (Figure C7-4).
6. Reconnect electrical connector.
7. Ignition "ON", ground diagnosis switch terminal.
8. Blow air into tube "A", air should exhaust from tube "B" now (Figure C7-4).
   If VSV solenoid fails the check, replace VSV.

EGR VALVE REPLACEMENT

Remove or Disconnect

1. Air cleaner assembly.
2. Vacuum hoses (2) from EGR valve.
3. Retaining bolts (2) from valve.
4. EGR valve & gasket.

Install or Connect

1. New gasket.
2. EGR valve.
3. Fasteners (2).
4. Tighten securely.
5. Vacuum hoses (2)
6. Air cleaner assembly.

EGR MODULATOR REPLACEMENT

Remove or Disconnect

1. Air cleaner assembly.
2. Vacuum hoses (3).
3. Modulator.

Install or Connect

1. Vacuum hoses (3) to modulator.
2. Air cleaner assembly.

EGR VACUUM SWITCHING VALVE REPLACEMENT

Remove or Disconnect

1. Electrical connector.
2. Vacuum hoses (2) from VSV.
3. Two fasteners hold VSV to cowl.

Install or Connect

1. VSV to cowl with two fasteners.
2. Tighten securely.
3. Vacuum hose to VSV.
4. Electrical connector.

PARTS INFORMATION

PART NAME	GROUP
EGR Valve	3.670
EGR Gasket	3.680
EGR Modulator Assembly	3.670
3-Way Solenoid Valve	3.670

SECTION C8

MANUAL TRANSAXLE (M/T) SHIFT LIGHT

CONTENTS

GENERAL DESCRIPTION C8-1
DIAGNOSIS C8-1
ON-VEHICLE SERVICE C8-1

GENERAL DESCRIPTION

The purpose of the shift light is to provide a display which indicates the optimum fuel economy point for upshifting the manual transaxle based on engine speed and load. The display lamp is located in the instrument panel and is activated by the ECM when:

- Vehicle speed is higher than 3 mph (5 km/h)
- Both Idle Switch and WOT Switch are "OFF".
- Engine speed is greater than 1500 RPM.
- Engine speed will vary with intake manifold pressure and engine coolant temperature.

The shift light will dim slightly when the headlights and/or parking lights are turned "ON". This is to give better visibility.

DIAGNOSIS

The shift light circuit can be checked using CHART C-8.

ON-VEHICLE SERVICE

See Section "8A" to repair wiring problem.

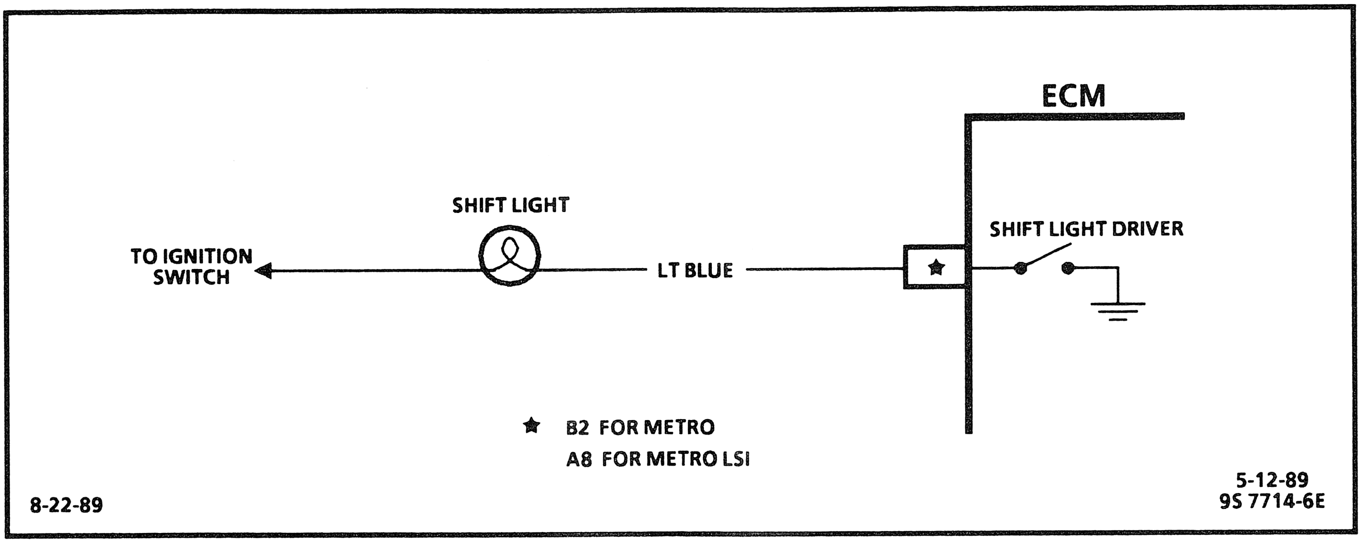

ECM
SHIFT LIGHT
SHIFT LIGHT DRIVER
TO IGNITION SWITCH
LT BLUE
★
★ B2 FOR METRO
A8 FOR METRO LSI
8-22-89
5-12-89
9S 7714-6E

CHART C-8

MANUAL TRANSAXLE (M/T) SHIFT LIGHT CHECK
1.0L (VIN 6) "M" CARLINE (TBI)

Circuit Description:

The shift light indicates the best transaxle shift point for maximum fuel economy. The light is controlled by the ECM and is turned "ON" by grounding the LT BLU wire from the light to the ECM.

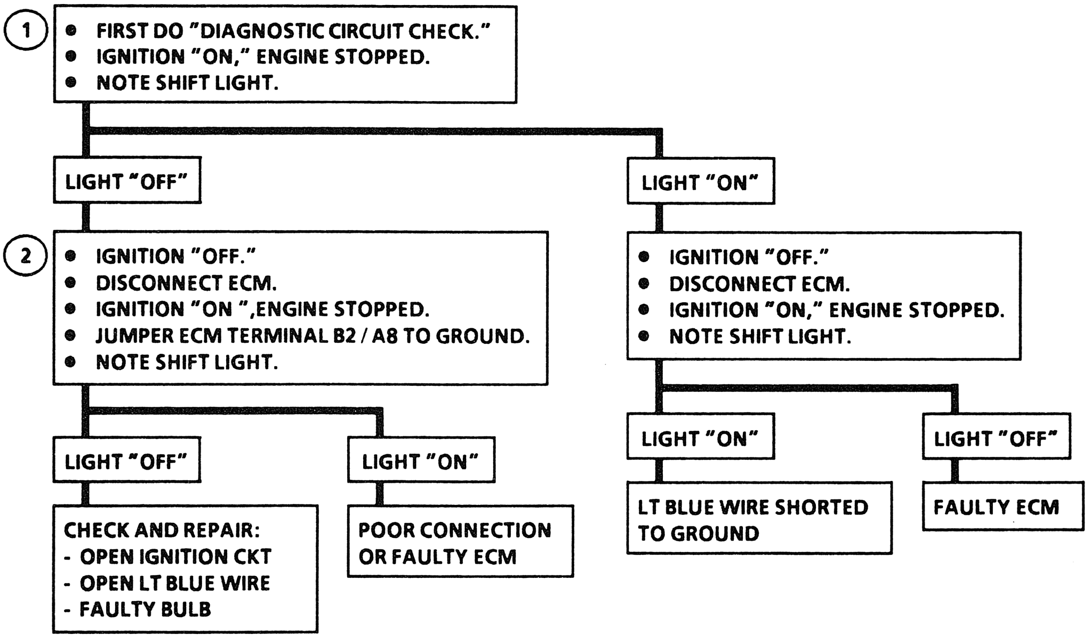
If the LT BLU wire is grounded the lamp will be "ON" all the time. If the circuit is open the lamp will not be "ON" when commanded by the ECM.

Test Description: Numbers below refer to circled numbers on the diagnostic chart.

1. This should not turn the shift light "ON". If it does, the LT BLU wire is shorted to ground or the ECM is faulty.
2. This checks the shift light circuit up to the ECM connector.

CHART C-8

MANUAL TRANSAXLE (M/T) SHIFT LIGHT CHECK
1.0L (VIN 6) "M" CARLINE (TBI)


①
• FIRST DO "DIAGNOSTIC CIRCUIT CHECK."
• IGNITION "ON," ENGINE STOPPED.
• NOTE SHIFT LIGHT.
LIGHT "OFF"
LIGHT "ON"
②
• IGNITION "OFF."
• DISCONNECT ECM.
• IGNITION "ON ",ENGINE STOPPED.
• JUMPER ECM TERMINAL B2 / A8 TO GROUND.
• NOTE SHIFT LIGHT.
• IGNITION "OFF."
• DISCONNECT ECM.
• IGNITION "ON," ENGINE STOPPED.
• NOTE SHIFT LIGHT.
LIGHT "OFF"
LIGHT "ON"
LIGHT "ON"
LIGHT "OFF"
CHECK AND REPAIR:
- OPEN IGNITION CKT
- OPEN LT BLUE WIRE
- FAULTY BULB
POOR CONNECTION OR FAULTY ECM
LT BLUE WIRE SHORTED TO GROUND
FAULTY ECM

95-12-89
9S 7715-6E

SECTION C13

POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM

CONTENTS

GENERAL DESCRIPTION C13-1
OPERATION C13-1
RESULTS OF INCORRECT OPERATION ... C13-1
DIAGNOSIS C13-2
FUNCTIONAL CHECK OF PCV VALVE ... C13-2
ON-VEHICLE SERVICE C13-2
PARTS INFORMATION C13-2

GENERAL DESCRIPTION

The compressed combustion gas which passes by the piston into the crankcase is known as blow-by gas. This gas contains large amounts of CO and HC. The PCV (Positive Crankcase Ventilation) system (Figure C13-1) is provided to prevent the blow-by-gas from being emitted into atmosphere and it operates as follows.

When the vacuum in the intake manifold is low (throttle valve open), the PCV valve is wide open due to its spring force. Thus a large amount of the blow-by-gas is drawn into the intake manifold.

On the other hand, when the vacuum in the manifold is high, the PCV valve opening is limited due to the high vacuum. Thus the amount of the blow-by-gas drawn into the intake manifold is small.

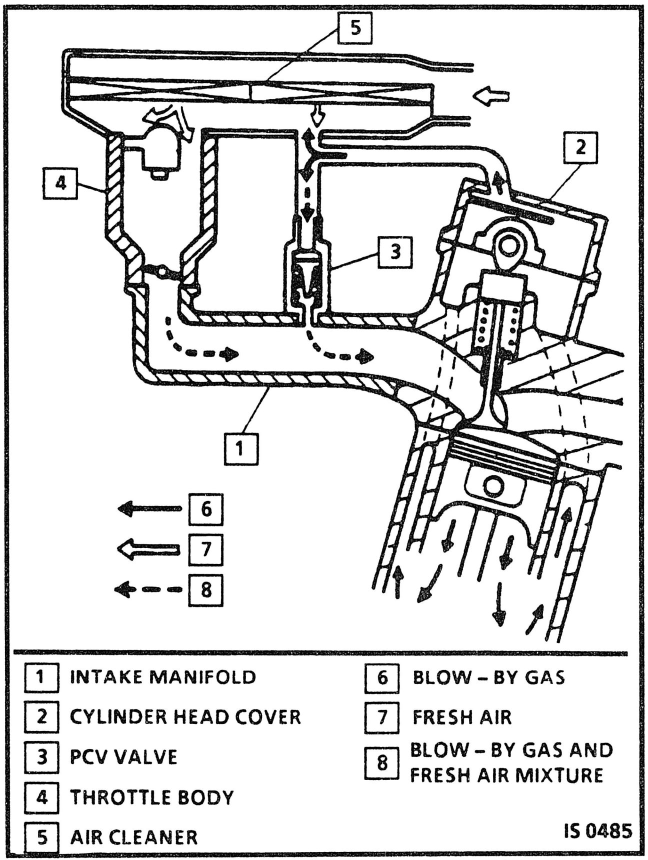


Figure C13-1 - PCV System Operation

OPERATION

The primary control is through the PCV valve (Figure C13-2) which meters the flow at a rate depending on manifold vacuum.

To maintain idle quality, the PCV valve restricts the flow when intake manifold vacuum is high. If abnormal operating conditions arise, the system is designed to allow excessive amounts of blow-by gases to back flow through the crankcase vent tube into the air cleaner to be consumed by normal combustion.

RESULTS OF INCORRECT OPERATION

A plugged valve or hose may cause:

- rough idle
- stalling or slow idle speed
- oil leaks
- oil in air cleaner
- sludge in engine

A leaking valve or hose would cause:

- rough idle
- stalling
- high idle speed

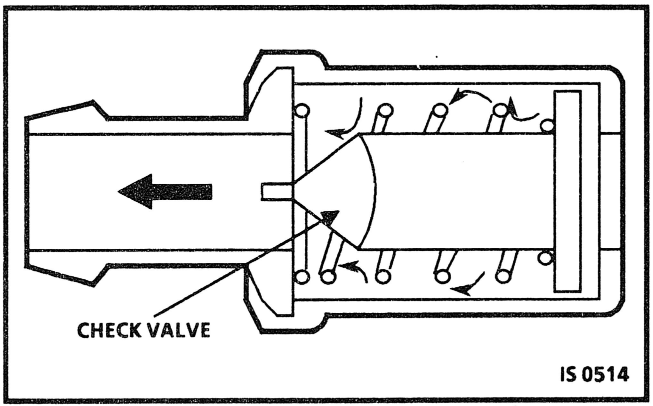


Figure C13-2 - PCV Valve Cross Section

DIAGNOSIS

FUNCTIONAL CHECK OF PCV VALVE

If an engine is idling rough, check for a clogged PCV valve or plugged hose. Replace as required. Use the following procedure:

1. Remove PCV valve from intake manifold.
2. Run the engine at idle.
3. Place your thumb over end of valve to check for vacuum. If there is no vacuum at valve, check for plugged hoses or manifold port, or PCV valve. Replace plugged or deteriorated hoses.
4. Turn "OFF" the engine and remove PCV valve. Shake valve and listen for the rattle of needle inside the valve. If valve does not rattle, replace valve.

With this system, any blow-by in excess of the system capacity (from a badly-worn engine, sustained heavy load, etc.) is exhausted into the air cleaner and is drawn into the engine.

Proper operation of the PCV system is dependent upon a sealed engine. If oil sludging or dilution is noted, and the PCV system is functioning properly, check engine for possible cause and correct to ensure that system will function as intended.

ON-VEHICLE SERVICE

An engine which is operated without any crankcase ventilation can be damaged. Therefore, it is important to replace the PCV valve and air inlet filter/separator (where used) at intervals shown in MAINTENANCE AND LUBRICATION (SECTION 0B).

Periodically inspect the hoses and clamps and replace any showing signs of deterioration.

PARTS INFORMATION

PART NAME	GROUP
Air Cleaner	3.402
Tube, Cr/Case Vent	1.762
Valve Asm, Cr/Case Vent	1.745

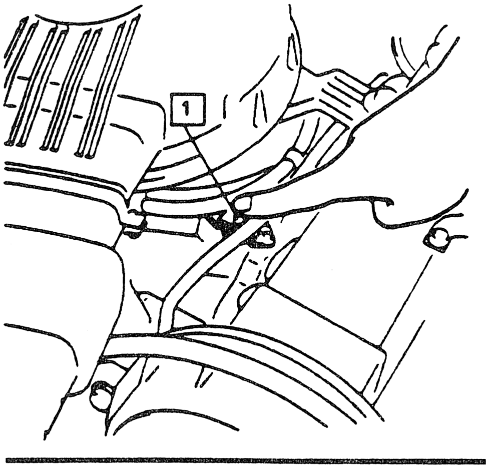


Figure C13-3 - PCV Location

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SECTION 6F

EXHAUST SYSTEM

CAUTION: Exhaust system components should have enough clearance from the underbody to avoid overheating and possible damage to the passenger compartment carpets.

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ALL NEW GENERAL MOTORS VEHICLES ARE CERTIFIED BY THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY AS CONFORMING TO THE REQUIREMENTS OF THE REGULATIONS FOR THE CONTROL OF AIR POLLUTION FROM NEW MOTOR VEHICLES FACTORY STANDARDS. IN MOST CASES, THESE ADJUSTMENTS POINTS EITHER HAVE BEEN PERMANENTLY SEALED AND/OR MADE INACCESSIBLE TO PREVENT FACTORY PROCEDURE FOR TEMPORARILY REMOVING PLUGS, CAPS, ETC. FOR PURPOSES OF SERVICING, THE PRODUCT MUST BE STRICTLY FOLLOWED AND, WHEREVER PRACTICABLE, RETURNED TO THE ORIGINAL INTENT OF THE DESIGN.

GENERAL DESCRIPTION

The exhaust system consists of an exhaust manifold, an exhaust center pipe, a muffler, and a seal and gaskets, etc., and the exhaust center pipe has the catalytic converter.

The catalytic converter is an emission control device added to the exhaust system to lower the levels of Hydrocarbon (HC), Carbon Monoxide (CO), and Oxides of Nitrogen (NOX) pollutants in the exhaust gas.

The catalyst in the catalytic converter is of a "Three-way" type. **THE CATALTYIC CONVERTER REQUIRES THE USE OF UNLEADED FUEL ONLY.**

MAINTENANCE

CAUTION: To avoid the danger of being burned, do not touch the exhaust system when the system is hot. Any service on the exhaust system should be performed when the system is cool.

Every 12 months or 7,500 miles (12,000 km), and when the car is raised for other service, check the exhaust system as follows:

Inspect

- Rubber mountings for damage, deterioration, and out of position.
- The exhaust system for leaks, loose connections, dents, and damages. For specified torques on loosened nut or bolts, refer to "On Vehicle Service" in this section.
- Check the nearby body areas for damaged, missing, or mispositioned parts, open seams, holes, loose connections, or other defects which could permit exhaust fumes to seep into the car.
- Make sure that the exhaust system components have enough clearance from the under body to avoid overheating and possible damage to the passenger compartment carpet.
- Any defects should be fixed at once.

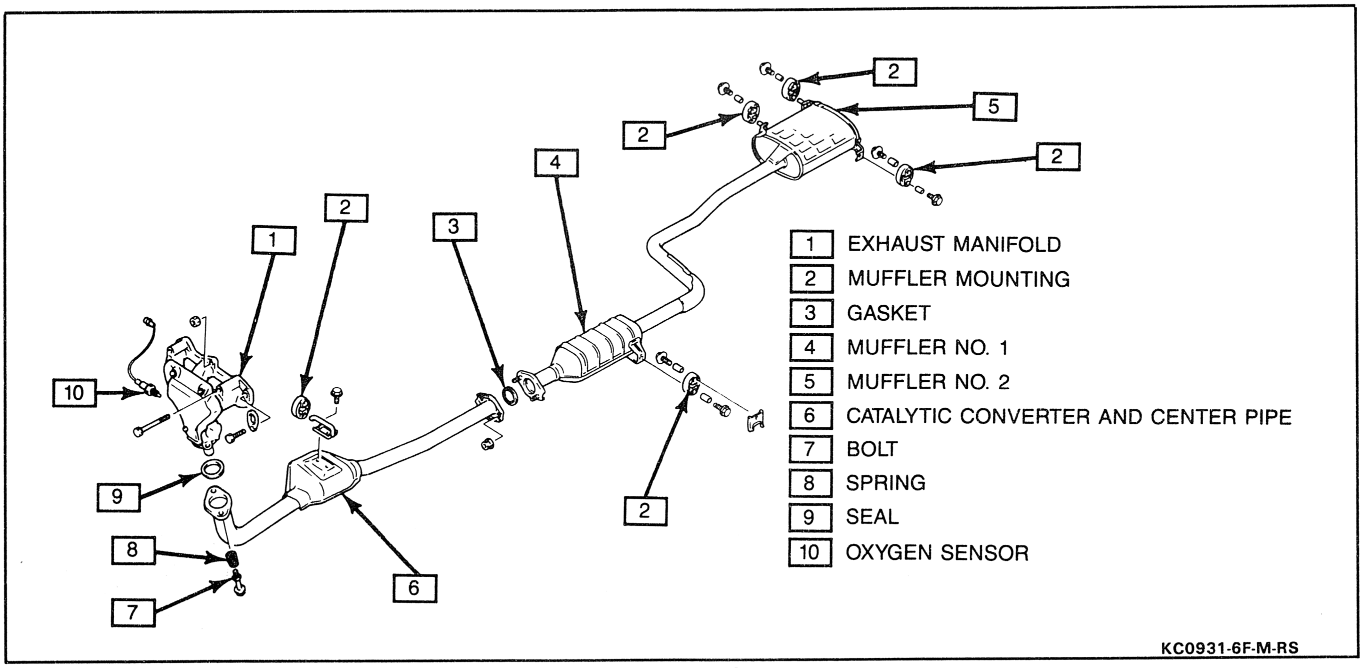
1
2
3
4
5
6
7
8
9
10
1 EXHAUST MANIFOLD
2 MUFFLER MOUNTING
3 GASKET
4 MUFFLER NO. 1
5 MUFFLER NO. 2
6 CATALYTIC CONVERTER AND CENTER PIPE
7 BOLT
8 SPRING
9 SEAL
10 OXYGEN SENSOR
KC0931-6F-M-RS

Figure 1 Exhaust System

DIAGNOSIS

CONDITION	POSSIBLE CAUSE	CORRECTION
Exhaust restriction	Restricted muffler No.1 or muffler No. 2.	Replace.
	Restricted catalytic converter.	Replace, and determine cause of malfunction (i.e., engine misfire, over rich fuel mixture, etc.).
	Restricted exhaust manifold.	Remove and clear blockage, or replace as necessary.
	Loose or broken element in catalytic converter.	Replace, and determine cause of malfunction (i.e., engine misfire, over rich fuel mixture, etc.).
	Loose or broken muffler baffles.	Replace as necessary.
	Bent or kinked exhaust pipes.	Replace as necessary.

Condition	Possible Cause	Correction
Exhaust leakage or noise	Leaking pipes or components.	Replace damaged components or pipes.
	Loose connections.	Realign and tighten connections.
	Leaking flange gaskets.	Replace.
	Leaking exhaust manifold or gasket.	Tighten manifold and/or replace gasket.
	Loose or broken element in catalytic converter.	Replace, and determine cause of malfunction (i.e., engine misfire, over rich fuel mixture, etc.).
	Loose or broken muffler No. 1 or muffler No. 2.	Replace muffler No. 1 or muffler No. 2 as necessary.
	Exhaust components rubbing on vehicle chassis.	Realign and/or replace damaged components.

ON-VEHICLE SERVICE

NOTICE: If either muffler one or two needs to be replaced, replace the whole assembly.

For removal and installation procedures of exhaust manifold and center pipe, refer to ENGINE MECHANICAL (Section 6A).

Be sure to hoist vehicle whenever the muffler assembly, center pipe, or any part used to mount or connect them is being replaced.

NOTICE: As muffler center pipe has the catalytic converter in it, it should not be exposed to any impulse. Be careful not to drop it or hit it against something.

When exhaust manifold is removed:

Inspect

- Gaskets and seal for deterioration or damage. Replace them as necessary.

Tighten

- Bolts and nuts to specified torques.

SPECIFICATIONS

BOLTS AND NUTS	TIGHTENING TORQUE
MANIFOLD BOLTS AND NUTS	18 - 28 N•m 1.8 - 2.8 kg-m 13.5 - 20.0 lb.-ft.
EXHAUST PIPE BOLTS	40 - 60 N•m 4.0 - 6.0 kg-m 29.0 - 43.0 lb.-ft.
MUFFLER NUTS	30 - 40 N•m 3.0 - 4.0 kg-m 22.0 - 29.0 lb.-ft.

KC0932-6F-M-RS

Figure 2 Specifications

SECTION 7A

AUTOMATIC TRANSAXLE

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  Automatic Transaxle Brake Interlock System 7A-1
    Steering Lock 7A-1
    Shift Lock Solenoid 7A-1
    Manual Release 7A-1
General Service Procedures 7A-1
  Transaxle Fluid Level 7A-2
  Checking Fluid Level
    Transaxle at Normal Operating Temperature 7A-2
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  Fluid Change Intervals 7A-2
    Fluid Change Procedures 7A-2
    Checking Transaxle For Fluid Leakage 7A-3
  Cooling Line Flushing 7A-3
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  Oil Pan Gasket 7A-4
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  Direct Clutch Solenoid, Second Brake Solenoid and Solenoid Wiring 7A-5
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GENERAL DESCRIPTION

TRANSAXLE ASSEMBLY

The automatic transaxle consists of the hydraulic torque converter, electronically controlled 3-speed automatic transaxle, countershaft and differential.

The transaxle consists of 2 planetary gears, 2 disc clutches, 1 band brake, 1 disc brake and 1 one way clutch. Its operation is controlled by selecting a position from 6 positions ("P," "R," "N," "D," "2" and "L") manually by means of the selector lever mounted on the compartment floor.

In the "D" range, the gear ratios are changed from 1st to 2nd and 2nd to 3rd automatically by electronic control. In the "2" position, the transaxle automatically changes the gear ratios from 1st to 2nd by the same electronic controls.

AUTOMATIC TRANSAXLE BRAKE INTERLOCK SYSTEM

The automatic transaxle brake interlock system is designed to prevent the selector lever from being shifted out of the "P" position unless the ignition switch is turned to "ON" and the brake pedal is depressed. The system also prevents the ignition key from being removed unless the selector lever is in "P."

Steering Lock

When the selector lever is in any position other than "P," the lock lever prevents the ignition key cylinder from being turned to the "LOCK" position which keeps the steering unlocked. When the selector lever is shifted to "P," the lock lever is released, which allows the ignition key to be removed and the steering to lock.

Shift Lock Solenoid

The selector lever is held in the "P" position unless the ignition switch is turned to "ON" and the brake pedal is depressed. When both of these conditions are satisfied, an electronic solenoid retracts the lock plate and the selector lever is allowed to move from the "P" position.

Manual Release

The selector assembly is also equipped with a manual release device. Pulling the release knob will release the selector lever without having the ignition switch in the "ON" position or depressing the brake pedal.

GENERAL SERVICE PROCEDURES

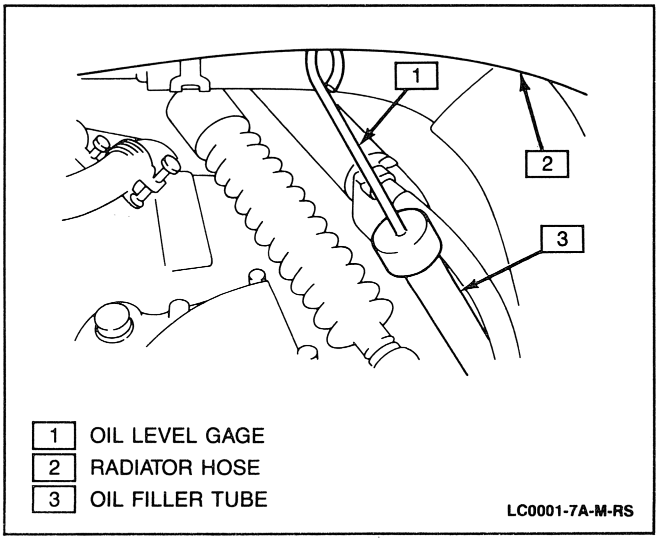


Figure 7A-1 Oil Level Gage and Oil Filler Tube

TRANSAXLE FLUID LEVEL

Figures 7A-1 and 7A-2

Checking Fluid Level (Transaxle at Normal Operating Temperature)

Be sure to check fluid level at every engine oil change. Because the automatic transaxle is designed to operate at normal fluid operating temperature, perform fluid level check when fluid temperature is within the temperature range of 70 to 80° C (158 to 175° F). Driving at 60 km/h (37 mile/h) in "D" range for about 15 minutes will raise fluid temperature to normal operating temperature. Fluid level check procedure is as follows:

1. Place vehicle on level surface.
2. Apply parking brake and block vehicle wheels.
3. With selector lever in "P" position, start engine. Do not race engine.
4. Run engine at idle and move selector lever through each range and return to the "P" position.
5. With engine running at idle, remove oil level gage from filler and wipe off.
6. Reinsert oil level gage into oil filler tube to its original position.
7. Remove the gage and check the oil level. The level should be between the "FULL HOT" and "LOW HOT" marks. If the level is below the "LOW HOT" mark, add fluid to bring the level to the "FULL HOT" mark. Bringing the fluid level from "LOW HOT" mark to "FULL HOT" mark requires 0.3 liters (0.70/0.58 US/Imp pt) of fluid. Use DEXTRON II or equivalent automatic transmission fluid.

NOTICE: Do not overfill. Overfilling may cause foaming and loss of fluid through the vent. Transaxle slippage and mechanical failure may result.

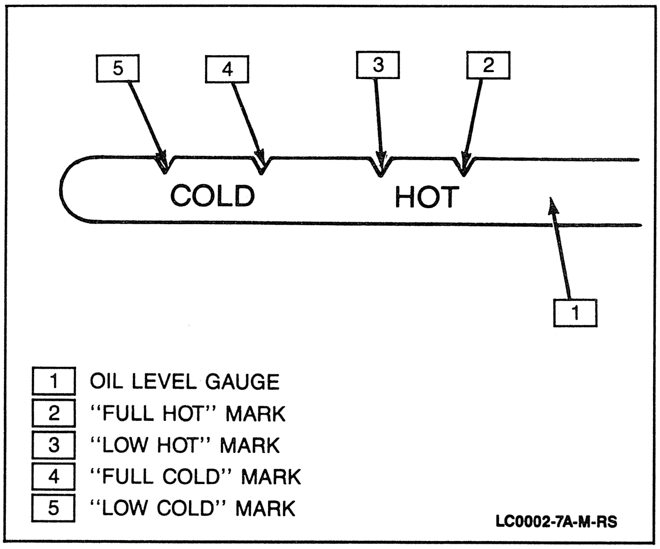


Figure 7A-2 Fluid Level Marks

Checking Fluid Level (Transaxle at Room Temperature of About 25° C (77° F))

If the transaxle has been overhauled or the fluid has been drained for oil pan and/or valve body service, refill the transaxle after assembling and check its level according to the following procedures:

1. Place vehicle on level surface.
2. Apply parking brake and block wheels.
3. With selector level in "P" position, start engine and run it at idle for 5 minutes. Do not race engine.
4. Move selector lever through each range and place the lever in "P" position again.
5. With engine running at idle, check fluid level on oil level gage. Fluid level should be between "FULL COLD" and "LOW COLD" marks on the oil level gage.
6. If level is below "LOW COLD" mark, add fluid to bring the level between "LOW COLD" and "FULL COLD" marks. Use DEXTRON II or equivalent automatic transmission fluid. Do not overfill.
7. The above COLD level check is strictly temporary. Therefore, as a final check, check fluid level for proper level through HOT level check at normal operating temperature. Refer to "Checking Transaxle Fluid (Transaxle at Normal Operating Temperature)" earlier in this section.

FLUID CHANGE INTERVALS

Figure 7A-3

Under normal driving conditions, change transaxle fluid every 100,000 km (160,000 miles). Change fluid every 15,000 miles (25,000 km) if the vehicle is usually driven under one or more of the following conditions which are considered severe transaxle service.

1. In heavy city traffic where outside temperature regularly reaches 32° C (90° F).
2. In very hilly or mountainous areas.
3. Commercial use, such as taxi, police vehicle or delivery service.

Fluid Change Procedure

1. Raise and suitably support vehicle. Refer to GENERAL INFORMATION (SEC.0A).
2. With transaxle cool, remove drain plug and drain fluid.
3. Install drain plug gasket and drain plug to oil pan, and tighten to 23 N·m (16.5 lb.ft.). Lower vehicle.
4. Remove oil level gage from oil filler tube and add 1.5 liters (3.16/2.64 US/Imp. pt) of new fluid through oil filler tube. Use DEXTRON II or equivalent transmission fluid.

   When refilling transaxle with fluid after it is overhauled, add about 3.5 liters (about 3.7/3.1 US/Imp. qt) assuming that torque converter is reused.

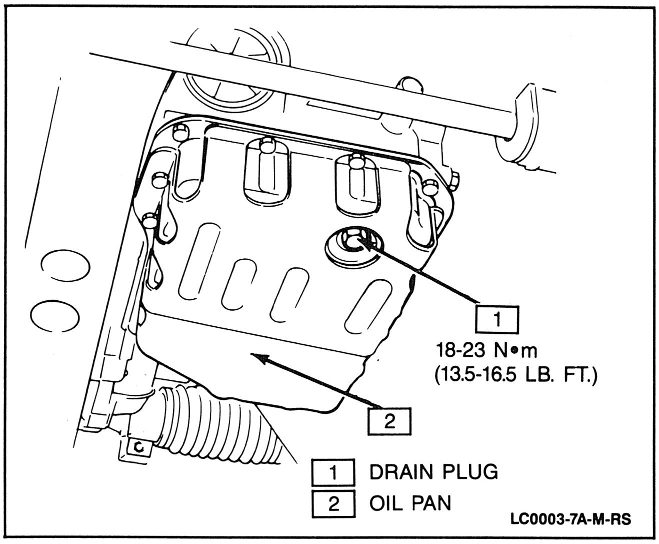


Figure 7A-3 Drain Plug

When filling dry torque converter and transaxle assembly with fluid, add about 4.9 liters (about 5. 2/4.3 US/Imp.qt) of DEXTRON II transaxle fluid to the transaxle.

5. Check fluid level with transaxle at room temperature and at normal operating temperature. Refer to "Checking Fluid Level" earlier in this section.

Checking Transaxle For Fluid Leakage

Check the transaxle (including oil hoses) for fluid leakage each time the vehicle is on a hoist. Inspect the oil hoses (inlet and outlet) for loose connections, deterioration or damage. If there is deterioration or damage, replace hoses.

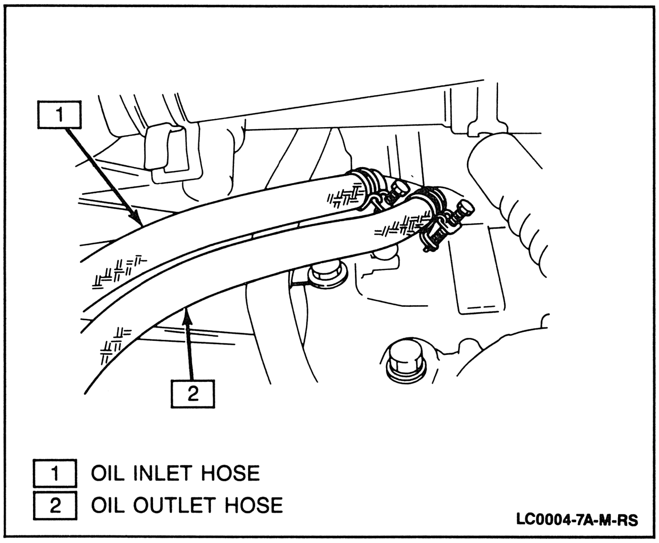


Figure 7A-4 Oil Cooler Inlet/Outlet Hoses

COOLING LINE FLUSHING

Figure 7A-4

In a major transaxle failure, where particles of metal have been carried with the oil throughout the units of the transaxle, it will be necessary to flush out the oil cooler and connecting lines. To flush the oil cooler and lines, use the following procedure:

1. Disconnect both cooler lines from the transaxle.
2. Place a hose over the end of the cooler inlet line (from the bottom of the cooler) and insert the hose into an empty container.
3. Flush clean oleum solvent or equivalent through the return line (from the top of the cooler) using an oil suction gun until clean solvent comes out of the hose. This will "back flush" the cooler.
4. Remove the hose from the inlet cooler line and place it on the return line.
5. Flush clean oleum solvent or equivalent through the inlet line until clean solvent comes out of the return line. Remove remaining solvent from cooler with compressed air applied to the return line and flush with transmission fluid.
6. Reconnect oil cooler lines.

ENGINE COOLANT IN TRANSAXLE

If the transaxle oil cooler, located in the radiator assembly, has developed a leak allowing engine coolant to enter the transaxle, use the following procedure:

1. Remove transaxle from vehicle. Refer to "Transaxle Assembly" later in this section.
2. Disassemble transaxle and replace all rubber type seals. (The coolant will attack the seal material causing leakage.) Refer to AUTOMATIC TRANSAXLE (SEC.7A1).
3. Replace the composition-faced clutch plate assemblies. (The facing material may become separated from the steel portion.)
4. Replace the nylon washers, speedometers gears and governor gear. (The nylon can swell and become damaged.)
5. Flush the converter, including T.C.C. types.
6. Thoroughly clean and rebuild transaxle, using new gaskets and oil filter.
7. Flush the cooler lines after the transaxle cooler has been properly repaired or replaced.

ON-VEHICLE SERVICE

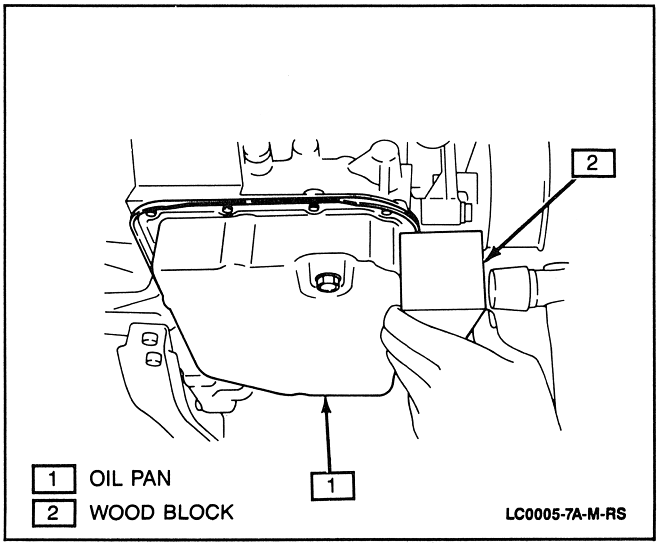


Figure 7A-5 Removing Oil Pan

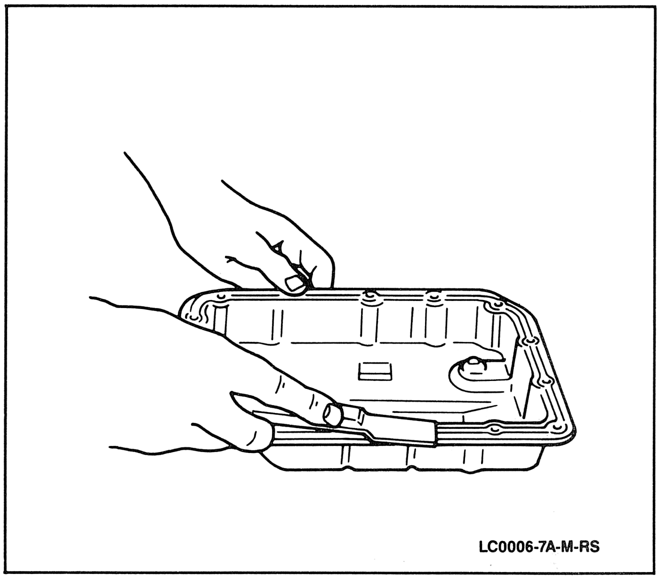

LC0006-7A-M-RS

Figure 7A-6 Removing Oil Pan Gasket

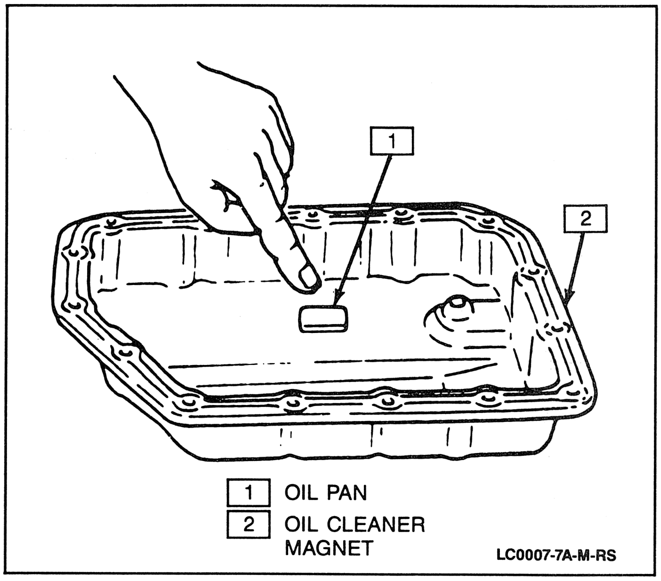

1
2
1 OIL PAN
2 OIL CLEANER MAGNET
LC0007-7A-M-RS

Figure 7A-7 Magnet Location

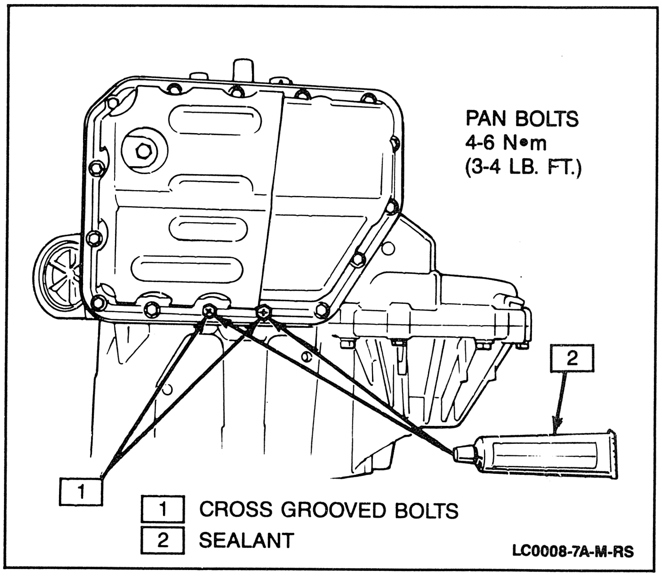

PAN BOLTS
4-6 N•m
(3-4 LB. FT.)
2
1
1 CROSS GROOVED BOLTS
2 SEALANT
LC0008-7A-M-RS

Figure 7A-8 Oil Pan Bolt Installation

OIL PAN GASKET

Figures 7A-5 through 7A-8

Remove or Disconnect

- Raise vehicle and drain transaxle fluid.

1. Oil pan bolts.
2. Oil pan from transaxle.

Important

- Do not force oil pan off by using a flat tip screwdriver, as it may cause damage to the gasket mating surfaces. Place a block of wood against side of oil pan and tap lightly with a hammer (Figure 7A-5).

Clean

- Oil pan gasket material from mating surface (Figure 7A-6).
- Inside of oil pan.
- Oil cleaner magnet (Figure 7A-7).

Install or Connect

1. New oil pan gasket on oil pan.
2. Oil pan on transaxle.
3. Oil pan bolts and tighten to 6 N·m (53 lb.in.).

Important

- There are 15 oil pan bolts in all and two of them have cross grooves in their heads. Install the two cross groove bolts in the proper positions after applying sealant to their threads. Do not apply sealant to remaining 13 bolts (Figure 7A-9).

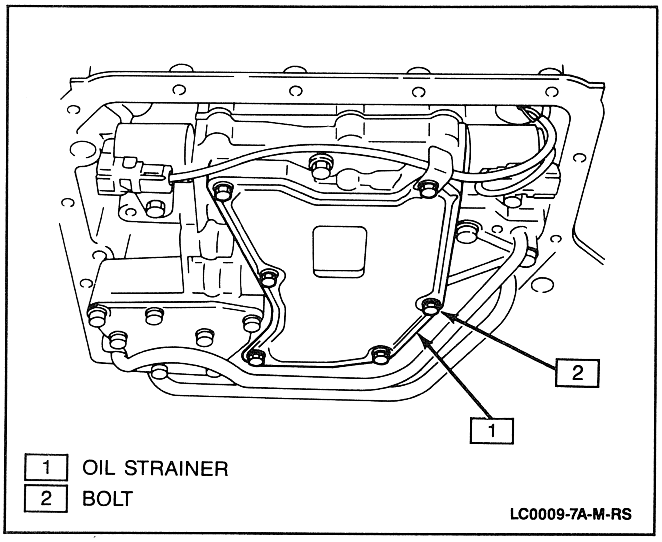

2
1
1 OIL STRAINER
2 BOLT
LC0009-7A-M-RS

Figure 7A-9 Oil Strainer

OIL STRAINER

Figure 7A-9

Remove or Disconnect

- Drain transaxle fluid. Refer to "Fluid Change Procedure" earlier in this section.

1. Oil pan. Refer to "Oil Pan Gasket" procedure earlier in this section.
2. Oil strainer bolts.
3. Oil strainer.

Clean

- Oil strainer.

Install or Connect

1. Oil strainer to lower valve body.

   Tighten

   - Oil strainer bolts to 6 N·m (53 lb.in.).
2. Oil pan.

   Tighten

   - Oil pan bolts to 6 N·m (53 lb.in.)
- Fill transaxle with fluid. Refer to "Fluid Change Procedure" earlier in this section.

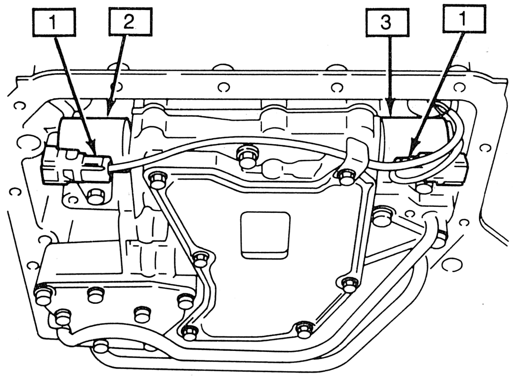

1
2
3
1
1 COUPLERS
2 2ND BRAKE SOLENOID
3 DIRECT CLUTCH SOLENOID
LC0010-7A-M-RS

Figure 7A-10 Solenoids

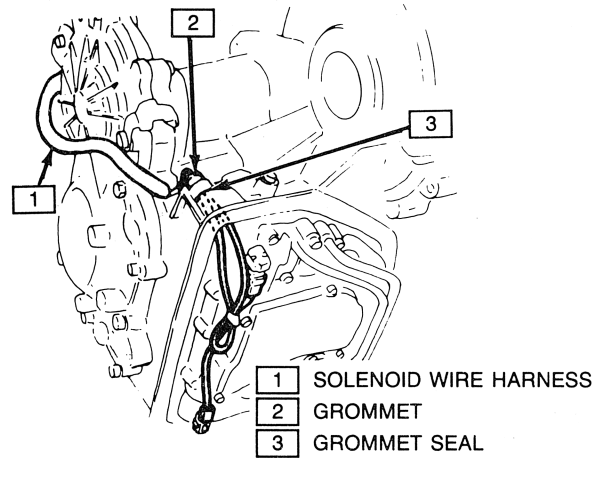

2
3
1
1 SOLENOID WIRE HARNESS
2 GROMMET
3 GROMMET SEAL
LC0011-7A-M-RS

Figure 7A-11 Solenoid Wiring Harness

DIRECT CLUTCH SOLENOID, 2ND BRAKE SOLENOID AND SOLENOID WIRING

Figures 7A-10 and 7A-11

Remove or Disconnect

- Drain transaxle fluid. Refer to "Oil Change Procedures" earlier in this section.

1. Oil pan. Refer to "Oil Pan Gasket" earlier in this section.
2. Couplers from direct clutch and 2nd brake solenoids.
3. Direct clutch solenoid.
4. Second brake solenoid.
5. Solenoid wire harness with grommet from upper side.

Inspect

- Grommet seal (o-ring). If damage is found replace grommet seal.

Install or Connect

1. Solenoid wiring harness and grommet seal to transaxle case.
2. Second brake solenoid to lower valve body.
3. Direct clutch solenoid to lower valve body.
4. Solenoid wires to each solenoid.
5. Oil pan to transaxle. Refer to "Oil Pan Gasket" earlier in this section.
6. Solenoid wire harness coupler.

- Fill transaxle with fluid. Refer to "Fluid Change Procedures" earlier in this section.

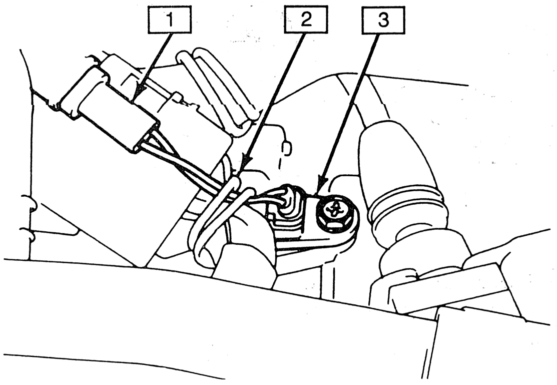

1
2
3
1 COUPLER
2 HARNESS CLAMP
3 SPEED SENSOR
KC1030-7A-M-RS

Figure 7A-12 Speed Sensor

SPEED SENSOR

Figure 7A-12

Remove or Disconnect

1. Wiring harness retainer clip.

2. Speed sensor electrical coupler.
3. Speed sensor bolt (Figure 7A-12).
4. Speed sensor.

Install or Connect

1. Speed sensor.
2. Speed sensor bolt.
3. Speed sensor electrical coupler.
4. Wiring harness retainer clip.

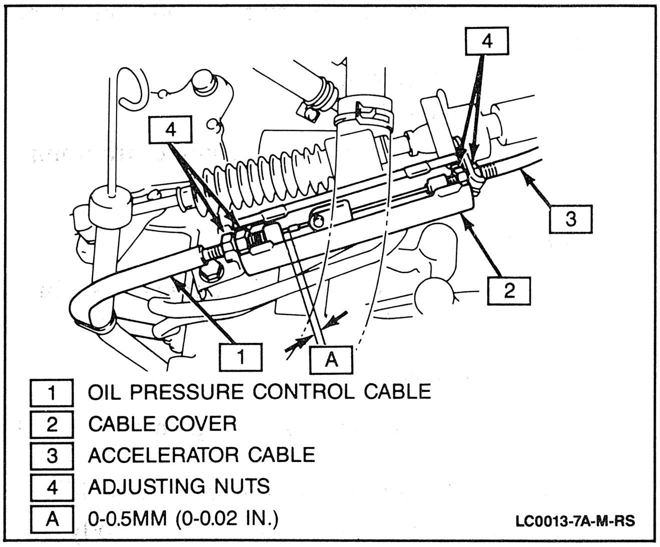

4
4
3
2
1
A
1 OIL PRESSURE CONTROL CABLE
2 CABLE COVER
3 ACCELERATOR CABLE
4 ADJUSTING NUTS
A 0-0.5MM (0-0.02 IN.)
LC0013-7A-M-RS

Figure 7A-13 Adjusting Oil Pressure Control Cable

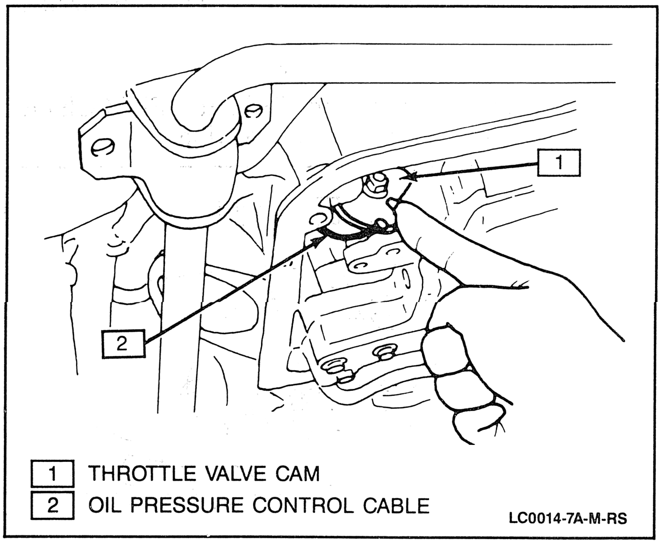

1
2
1 THROTTLE VALVE CAM
2 OIL PRESSURE CONTROL CABLE
LC0014-7A-M-RS

Figure 7A-14 Throttle Valve Cam

OIL PRESSURE CONTROL CABLE

Figures 7A-13 through 7A-15

Remove or Disconnect

- Drain transaxle fluid. Refer to "Fluid Change Procedure" earlier in this section.

1. Oil pressure control cable cover.
2. Oil pressure control cable from accelerator cable.
3. Oil pan. Refer to "Oil Pan Gasket" procedure earlier in this section.

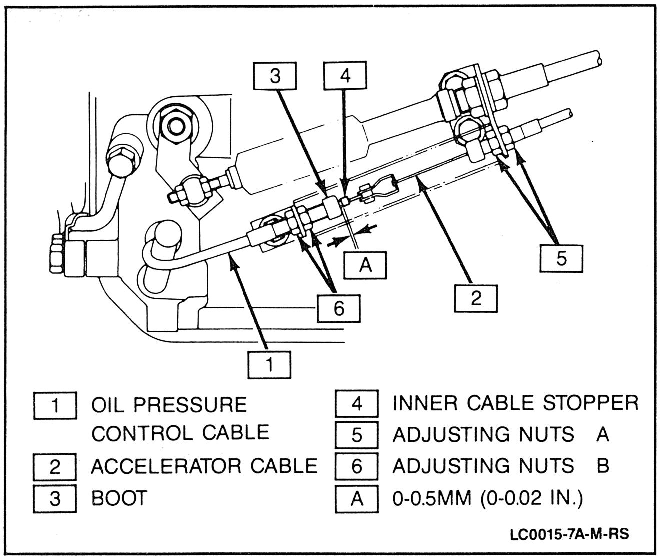

3
4
A
5
6
2
1
1 OIL PRESSURE CONTROL CABLE
2 ACCELERATOR CABLE
3 BOOT
4 INNER CABLE STOPPER
5 ADJUSTING NUTS A
6 ADJUSTING NUTS B
A 0-0.5MM (0-0.02 IN.)
LC0015-7A-M-RS

Figure 7A-15 Checking and Adjusting Oil Pressure Control Cable Play

4. Oil pressure control cable from throttle valve cam.
5. Oil pressure control cable from transaxle case.

Install or Connect

1. Oil pressure control cable to transaxle case.
2. Oil pressure control cable to throttle valve cam.
3. Oil pan. Refer to "Oil Pan Gasket" procedure earlier in this section.
4. Oil pressure control cable to accelerator cable.
5. Oil pressure control cable cover.

- Fill transaxle with fluid. Refer to "Change Procedure" earlier in this section.

Checking and Adjusting Oil Pressure Control Cable Play

Inspect

1. Accelerator cable for play and adjust if necessary. Refer to ENGINE FUEL (SEC.6C).
   - Start engine and run until operating temperature has been attained.
   - Remove oil pressure control cable cover.
2. Boot-to-inner stopper cable clearance with a feeler gage. If clearance is more than 0.5 mm (0.2 inch), adjust oil pressure control cable.

Adjust

- Oil pressure control cable by turning nut A until boot-to-inner stopper cable clearance.

Important

- Adjusting nuts B may also be used to adjust boot-to-inner stopper cable clearance.

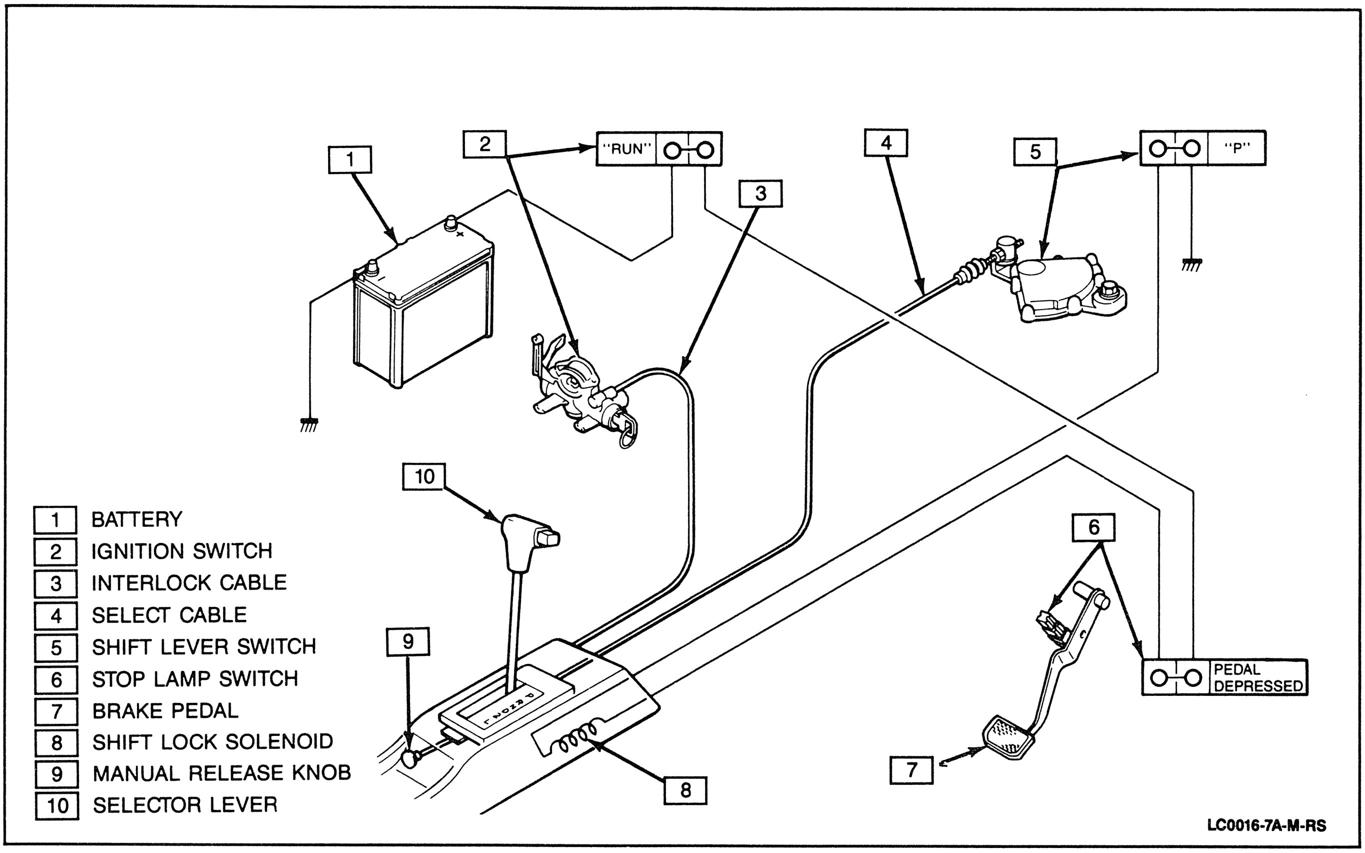

1
2
"RUN"
3
4
5
"P"
6
PEDAL DEPRESSED
7
8
9
10
1 BATTERY
2 IGNITION SWITCH
3 INTERLOCK CABLE
4 SELECT CABLE
5 SHIFT LEVER SWITCH
6 STOP LAMP SWITCH
7 BRAKE PEDAL
8 SHIFT LOCK SOLENOID
9 MANUAL RELEASE KNOB
10 SELECTOR LEVER
LC0016-7A-M-RS

Figure 7A-16 Automatic Transaxle Brake Interlock System Circuit

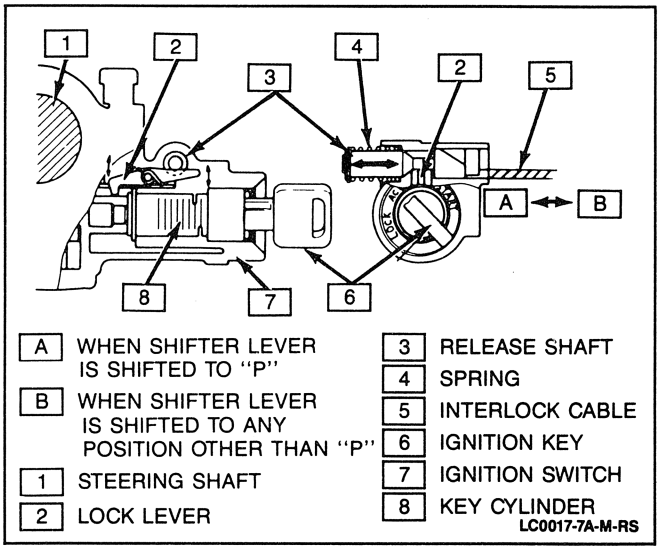

1
2
3
4
2
5
A
B
8
7
6
A WHEN SHIFTER LEVER IS SHIFTED TO "P"
B WHEN SHIFTER LEVER IS SHIFTED TO ANY POSITION OTHER THAN "P"
1 STEERING SHAFT
2 LOCK LEVER
3 RELEASE SHAFT
4 SPRING
5 INTERLOCK CABLE
6 IGNITION KEY
7 IGNITION SWITCH
8 KEY CYLINDER
LC0017-7A-M-RS

Figure 7A-17 Ignition Switch Lock Mechanism

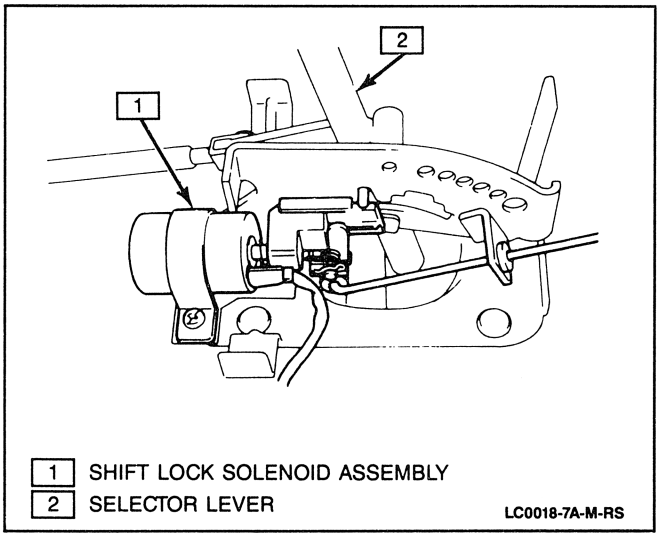

1
2
1 SHIFT LOCK SOLENOID ASSEMBLY
2 SELECTOR LEVER
LC0018-7A-M-RS

Figure 7A-18 Shift Lock Solenoid

SHIFT LOCK SOLENOID

Figures 7A-16 and 7A-18 through 7A-22

↔ Remove or Disconnect

1. Console box (if equipped).
2. Parking brake lever cover.
3. Shift control cover.
4. Solenoid electrical leads.
5. Solenoid retaining screws.
6. Shift lock solenoid (Figure 7A-20).

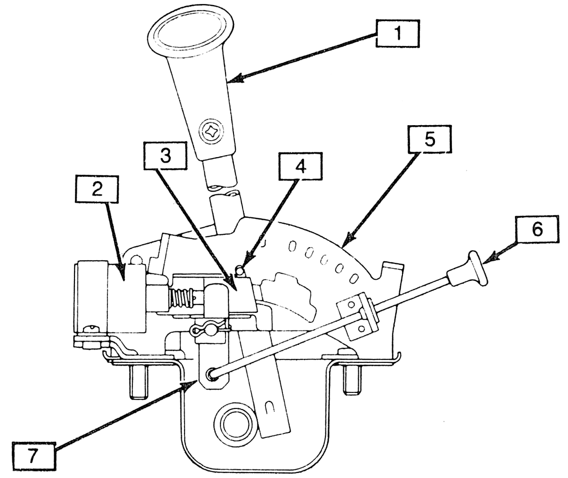
→← Install or Connect

- Shift the selector lever to "P" position.
- Apply grease to the upper and lower edges of the lock plate.

1. Shift lock solenoid (Figure 7A-20).
2. Solenoid retaining screws (tighten hand tight only).
3. Solenoid electrical leads.

Adjust

- Solenoid position so that the solenoid will operate as follows:

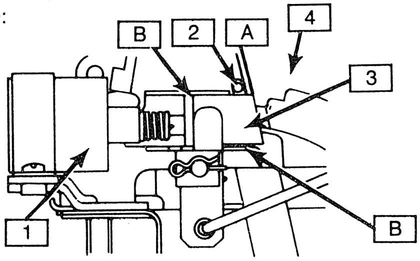


1	SELECTOR LEVER (IN "P" RANGE)
2	SHIFT LOCK SOLENOID
3	LOCK PLATE
4	DETENT PIN
5	DETENT PLATE
6	MANUAL RELEASE KNOB
7	MANUAL RELEASE PLATE

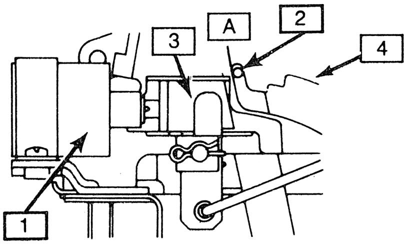
LC0019-7A-M-RS

Figure 7A-19 Selector Lever Locked in "P" Position

WHEN SHIFT LOCK SOLENOID IS NOT OPERATED:



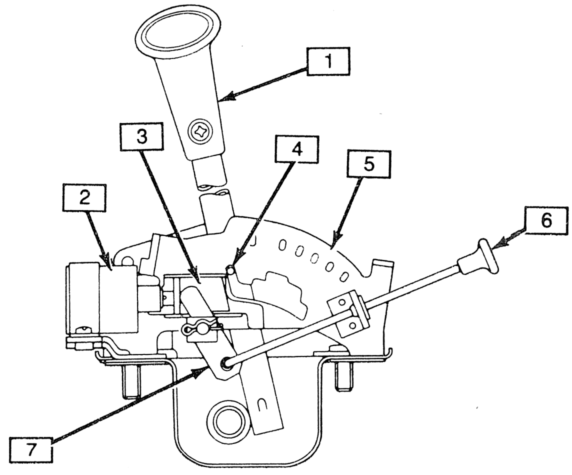
WHEN SHIFT LOCK SOLENOID IS OPERATED:



1	SHIFT LOCK SOLENOID
2	DETENT PIN
3	LOCK PLATE
4	DETENT PLATE
A	MORE THAN 1.0 MM (0.040 IN)
B	APPLY GREASE HERE

LC0021-7A-M-RS

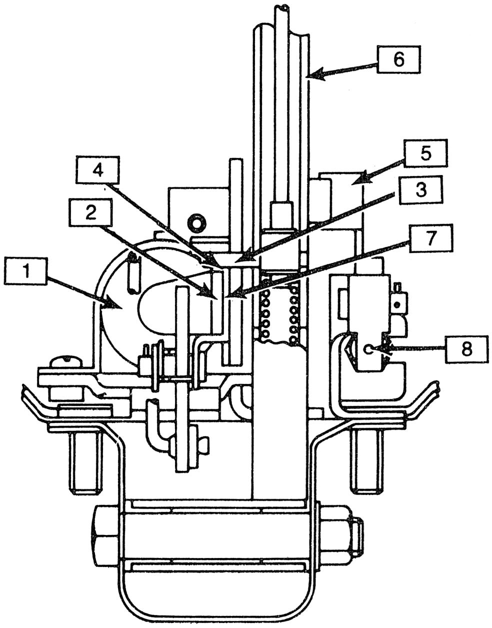
Figure 7A-21 Lock Plate Position (1)



1	SELECTOR LEVER (IN "P" RANGE)
2	SHIFT LOCK SOLENOID
3	LOCK PLATE
4	DETENT PIN
5	DETENT PLATE
6	MANUAL RELEASE KNOB
7	MANUAL RELEASE PLATE

LC0020-7A-M-RS

Figure 7A-20 Selector Lever Released



1	SHIFT LOCK SOLENOID	5	DETENT PIN
2	LOCK PLATE	6	SELECTOR LEVER
3	GUIDE PLATE	7	KEY RELEASE PLATE
4	"NO CLEARANCE"	8	INTERLOCK CABLE

LC0022-7A-M-RS

Figure 7A-22 Lock Plate Position (2)

   a. When ignition switch is turned "OFF," the solenoid is not operated.
   b. When the ignition switch is turned "ON," and the brake pedal is depressed, the solenoid is operated and the lock plate should be positioned as shown in Figure 7A-20.
   c. There is no clearance between lock plate and guide plate (Figure 7A-20).
   d. If the manual release knob is pulled with the ignition switch turned "OFF," the selector lever can be shifted from "P" range to any other range.

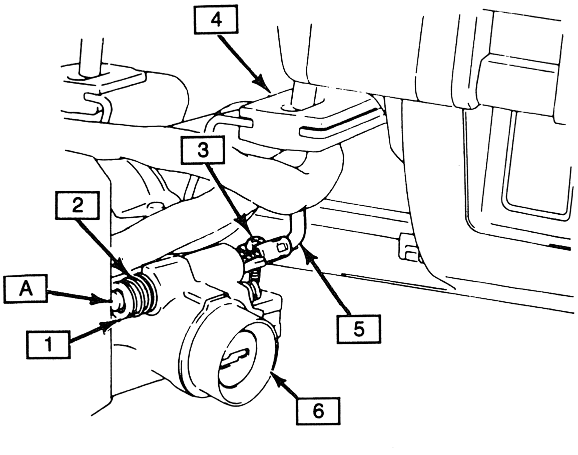
Tighten

- Solenoid retaining screws completely and be sure selector lever locks in "P" range cannot be shifted from "P" range to any other range while ignition switch is in the "OFF" position.

4. Shift control cover.
5. Parking brake lever cover.
6. Console box (if equipped).

Important

- When the ignition switch is turned "ON" and the brake pedal is depressed, the selector lever can be shifted from "P" range to any other range.



A PUSH IN FOR DISCONNECTION/ RECONNECTION OF CABLE
1 RELEASE SHAFT E-RING (DO NOT REMOVE)
2 RELEASE SHAFT SPRING
3 CLAMP SCREW
4 STEERING COLUMN
5 INTERLOCK CABLE
6 IGNITION SWITCH

LC0023-7A-M-RS

Figure 7A-23 Interlock Cable at Steering Lock

INTERLOCK CABLE

Figures 7A-23 through 7A-25

Remove or Disconnect

1. Steering column cover and column inspection cover.
2. Interlock cable clamp.
- Push in release shaft (A) (Figure 7A-23).
3. Cable end.
4. Console box (if equipped) and parking brake lever cover.
5. Shift lever cover.
- Loosen cable retaining nuts (Figure 7A-24).
6. Interlock cable.

Install or Connect

1. Interlock cable to selector lever.
2. Cable retaining nuts (Figure 7A-24).
3. Shift lever cover.
4. Parking brake lever cover and console box (if equipped).
5. Feed cable up to ignition switch.
- Push in release shaft (A) (Figure 7A-23).
7. Cable end.
8. Interlock cable clamp.
9. Steering column cover and column inspection cover.

Adjust

1. Shift selector to "P" position.
2. Nuts (A) and (B) on interlock cable till loose.
3. Outer wire (interlock cable) pulled forward so there is no deflection on inner wire, tighten nut (A) shown in Figure 7A-24 only hand-tight, then nut (B).

Tighten

- Nuts (A) and (B).

Important

- After tightening nuts (A) and (B), make sure that with selector lever shifted to "P" range, the ignition key can be turned from "ACC" to "LOCK" position and removed from ignition switch, and with selector lever shifted to any range other than "P" range, ignition key cannot be turned from "ACC" to "LOCK" position.

STOPLAMP SWITCH

Figure 7A-27

Remove or Disconnect

1. Battery negative (-) cable.
2. Steering joint cover.
3. Stoplamp switch connector.

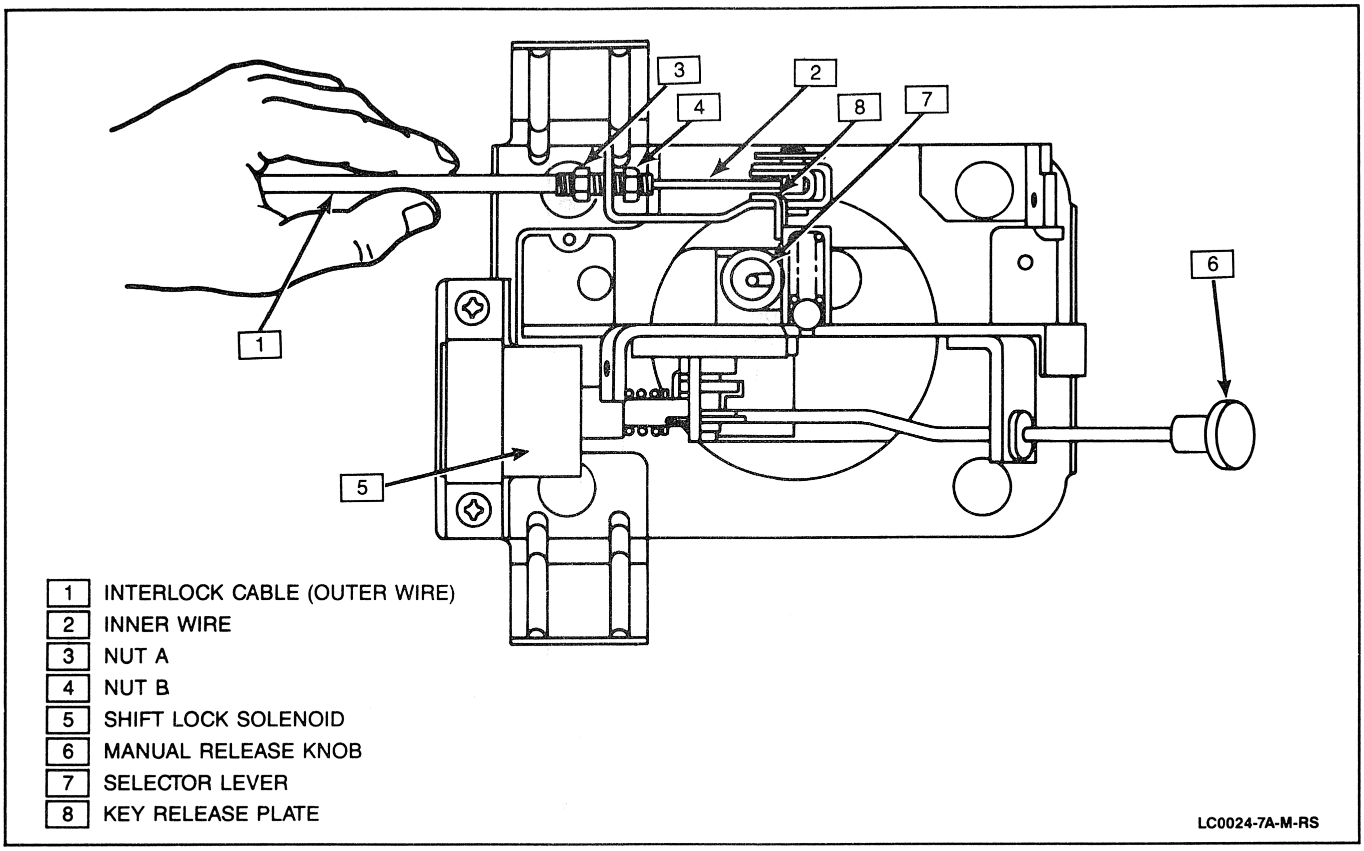

3
2
4
8
7
6
1
5
1 INTERLOCK CABLE (OUTER WIRE)
2 INNER WIRE
3 NUT A
4 NUT B
5 SHIFT LOCK SOLENOID
6 MANUAL RELEASE KNOB
7 SELECTOR LEVER
8 KEY RELEASE PLATE
LC0024-7A-M-RS

Figure 7A-24 Adjusting Interlock Cable

4. Stoplamp switch.

Install or Connect

1. Stoplamp switch.
2. Stoplamp switch connector.
3. Steering joint cover.
4. Battery negative (-) cable.

Adjust

1. Brake pedal by pulling toward you and holding it.
2. Switch so that clearance between end of thread and brake pedal contact plate is within 0.5 - 1.0 mm (0.02 - 0.04 in.).

Tighten

- Lock nut to 15 N·m (10.5 lb.ft.).

MANUAL SELECTOR

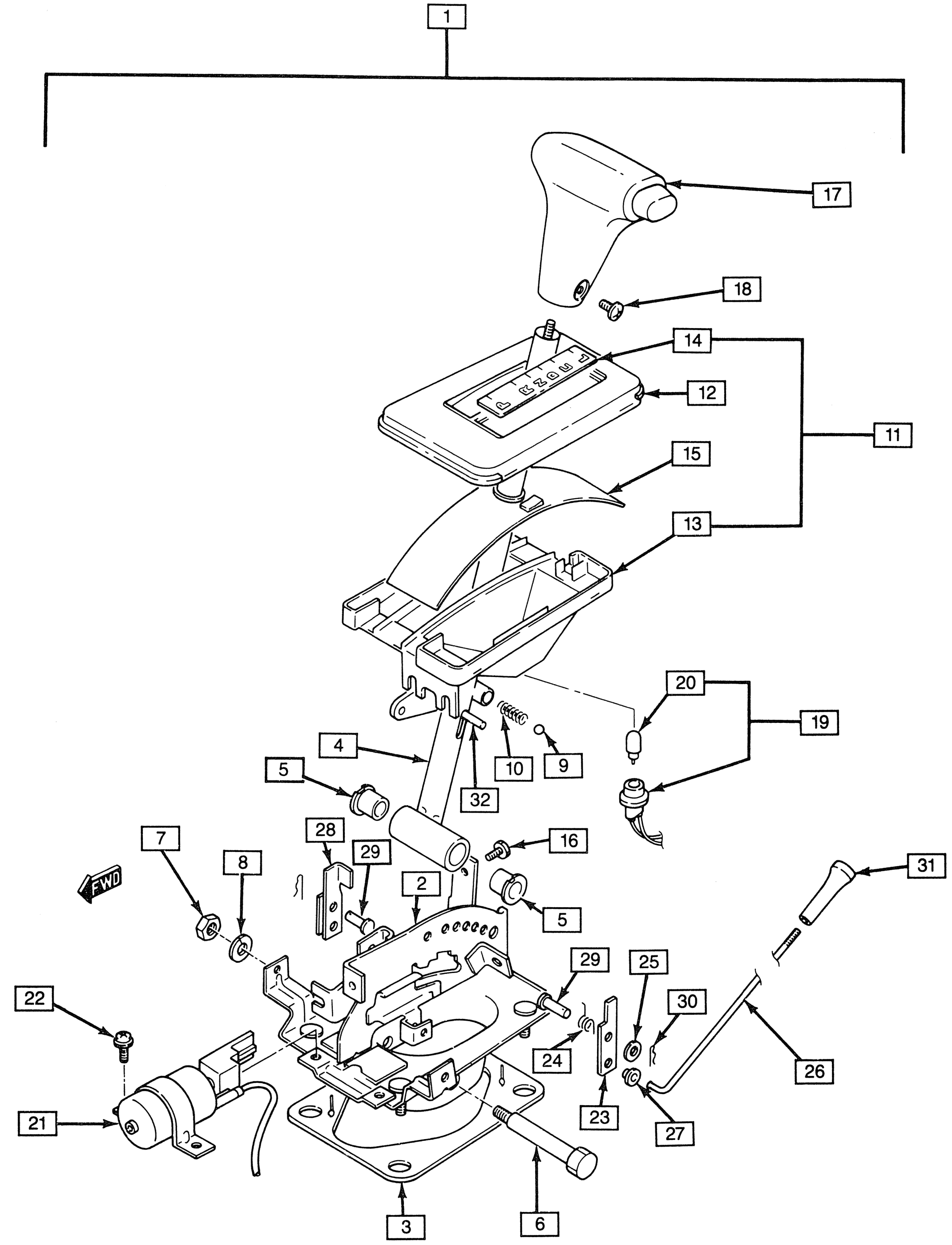
Figures 7A-21 through 7A-26

Remove or Disconnect

1. Selector knob.
2. Console box (if equipped).
3. Parking brake cover.
4. Shift lever cover.
5. Select indicator assembly.
6. Select cable from selector lever.
7. Interlock cable.
8. Interlock solenoid coupler.
- Raise and suitably support vehicle. Refer to GENERAL INFORMATION (SEC.0A).
9. Housing seat after removing 4 housing nuts.
10. Lever housing with selector lever from floor.

Install or Connect

1. Lever housing with selector lever to floor.
2. Housing seat with 4 housing nuts.
- Lower vehicle.
3. Interlock solenoid coupler.
4. Interlock cable. Refer to "Interlock Cable" procedure earlier in this section.
5. Select cable to selector lever. Refer to "Select Cable" procedure later in this section.
6. Select indicator assembly.
7. Console box (if equipped).
8. Parking brake cover.
9. Shift lever cover.
10. Selector knob.
- Apply grease to position (B) indicated (Figure 7A-21).


1
17
18
14
12
11
15
13
20
19
4
10
9
5
32
7
28
16
8
29
31
FWD
2
5
29
25
22
30
24
26
21
23
27
3
6

1	SELECTOR ASSEMBLY
2	SELECTOR LEVER HOUSING
3	HOUSING SHEET
4	SELECTOR LEVER
5	SELECTOR LEVER BUSH
6	SELECTOR LEVER SHAFT
7	NUT
8	LOCK WASHER
9	LOCATING BALL
10	LOCATING SPRING
11	INDICATOR ASSEMBLY
12	UPPER COVER
13	LOWER COVER
14	POSITION PLATE
15	SLIDE COVER
16	INDICATOR SCREW
17	SELECTOR LEVER KNOB
18	SCREW
19	ILLUMINATION LAMP
20	BULB
21	SHIFT LOCK SOLENOID
22	SOLENOID SCREW
23	MANUAL RETURN PLATE
24	MANUAL RETURN SPRING
25	WASHER
26	MANUAL RETURN ROD
27	MANUAL RETURN BUSH
28	KEY RELEASE PLATE
29	JOINT PIN
30	JOINT CLIP
31	MANUAL RETURN KNOB
32	DETENT PIN

LC0025-7A-M-RS

Figure 7A-25 Manual Selector Assembly

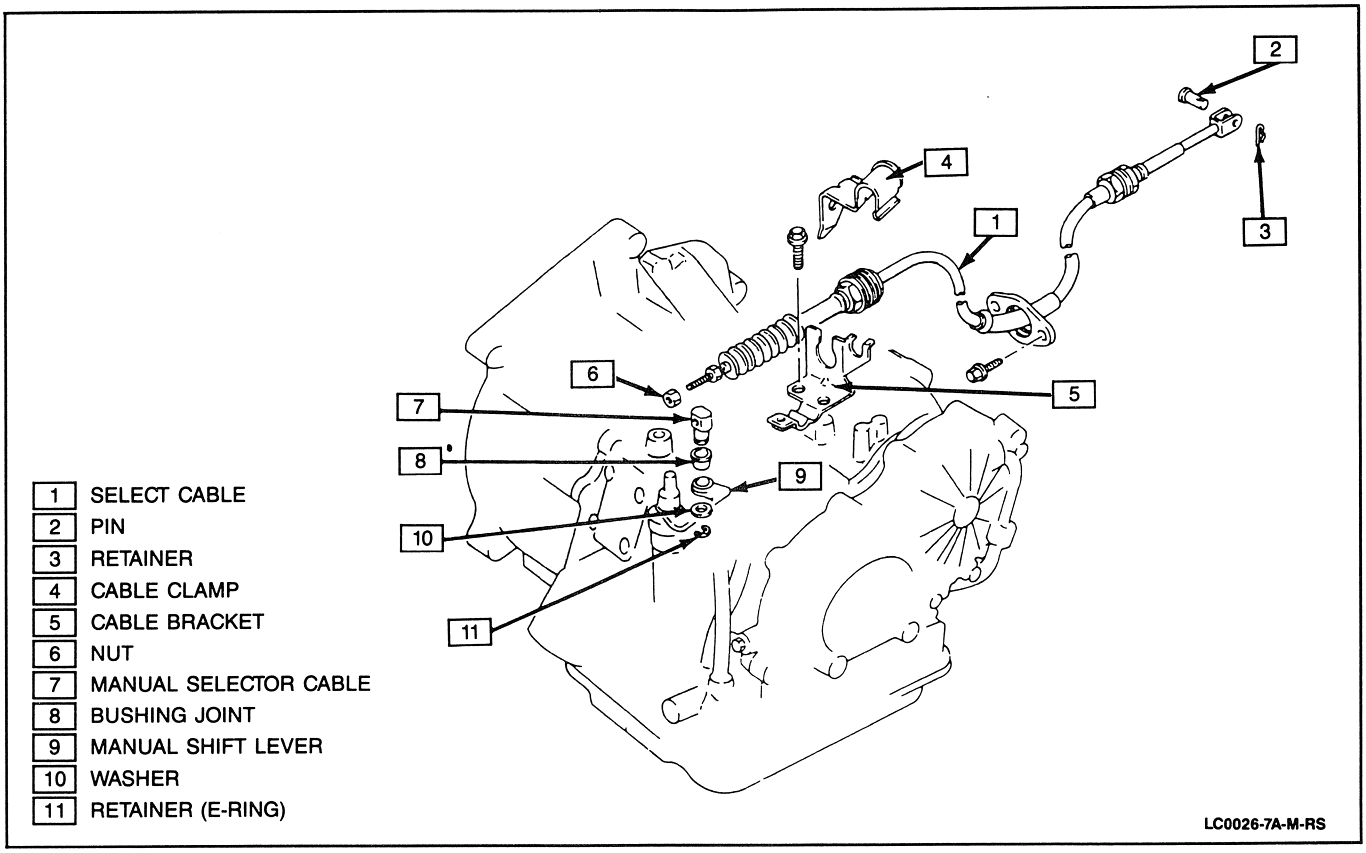

2
4
1
3
6
5
7
8
9
10
11
1 SELECT CABLE
2 PIN
3 RETAINER
4 CABLE CLAMP
5 CABLE BRACKET
6 NUT
7 MANUAL SELECTOR CABLE
8 BUSHING JOINT
9 MANUAL SHIFT LEVER
10 WASHER
11 RETAINER (E-RING)
LC0026-7A-M-RS

Figure 7A-26 Select Cable Components

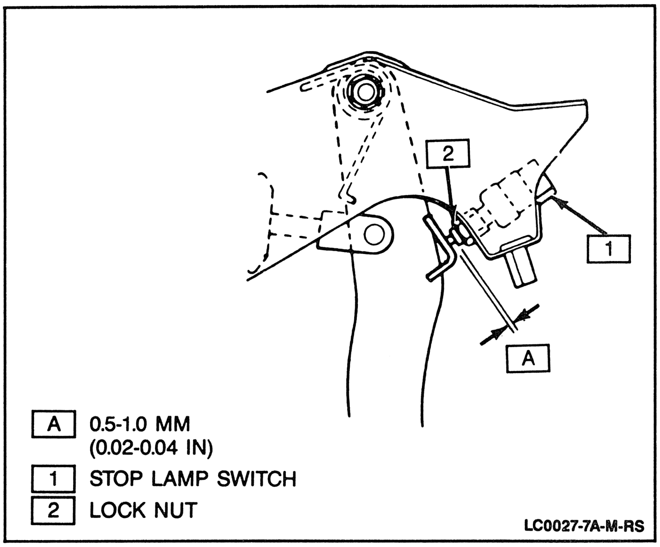

2
1
A
A 0.5-1.0 MM
(0.02-0.04 IN)
1 STOP LAMP SWITCH
2 LOCK NUT
LC0027-7A-M-RS

Figure 7A-27 Stoplamp Switch

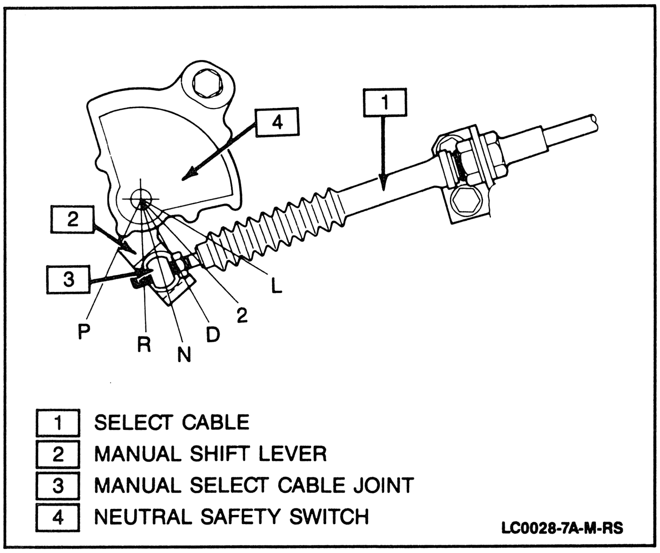

4
1
2
3
L
2
P
R
N
D
1 SELECT CABLE
2 MANUAL SHIFT LEVER
3 MANUAL SELECT CABLE JOINT
4 NEUTRAL SAFETY SWITCH
LC0028-7A-M-RS

Figure 7A-28 Manual Shift Select Cable Joint and Manual Shift Lever in "N" Position

SELECT CABLE

Figures 7A-28 through 7A-30

Remove or Disconnect

1. Console box (if equipped).
2. Parking brake lever cover.
3. Shift lever cover (Figure 7A-25).
4. Select indicator.
5. Select cable from selector lever.
6. Select cable from floor.
7. Select cable from transaxle.

- Raise and suitably support vehicle. Refer to GENERAL INFORMATION (SEC.0A).

8. Select cable from front panel.

- Lower vehicle.

Install or Connect

- Raise and suitably support vehicle. Refer to GENERAL INFORMATION (SEC.0A).

1. Select cable to front panel.

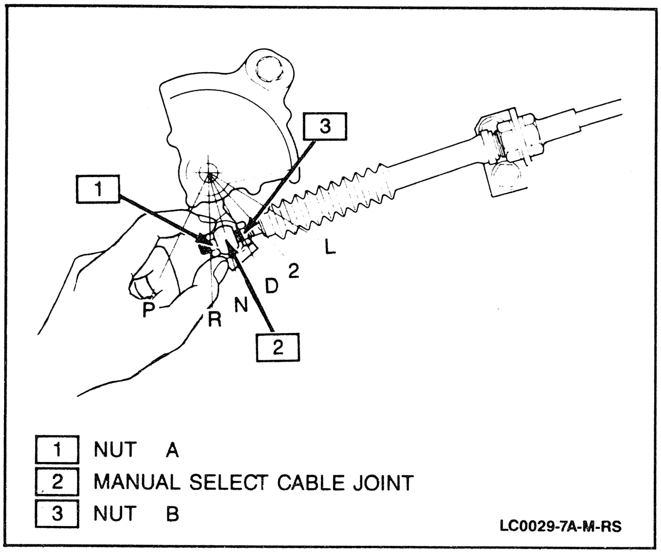

3
1
L
2
D
P
N
R
2
1 NUT A
2 MANUAL SELECT CABLE JOINT
3 NUT B
LC0029-7A-M-RS

Figure 7A-29 Select Cable Nuts A and B

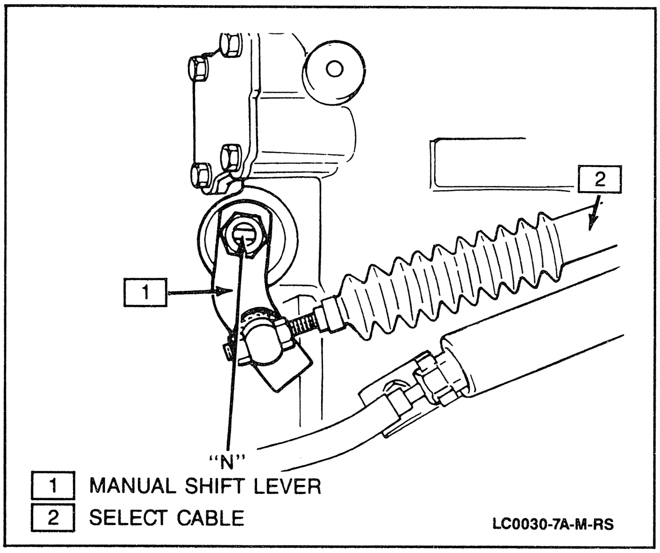

2
1
"N"
1 MANUAL SHIFT LEVER
2 SELECT CABLE
LC0030-7A-M-RS

Figure 7A-30 Manual Shift Lever in "N" Position

- Lower vehicle.
2. Select cable to floor.
3. Select cable to selector lever after greasing select cable pin.
4. Select indicator to lever housing.
5. Shift lever cover.
6. Parking brake lever cover.
7. Console box.
8. Select cable to select cable bracket on transaxle.
9. Select cable into manual select cable joint hole, and then shift manual shift lever to "N" range.

Adjust

1. Selector lever to "N" position.
2. Nut (A) by hand until it contacts manual select cable joint (Figure 7A-29).

Tighten

- Nut (B) with wrench.

Important

- After select cable is installed, check for the following:
  - a. Push vehicle with selector lever shifted to "P" position. Vehicle should not move.
  - b. Vehicle cannot be driven in "N" position.
  - c. Vehicle can be driven in "D," "2," and "L" positions.
  - d. Vehicle can be backed in "R" position.

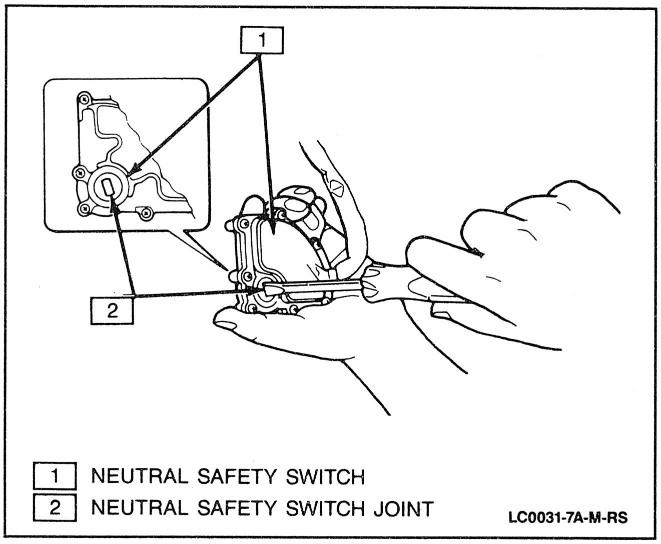

1
2
1 NEUTRAL SAFETY SWITCH
2 NEUTRAL SAFETY SWITCH JOINT
LC0031-7A-M-RS

Figure 7A-31 Neutral Safety Switch Joint

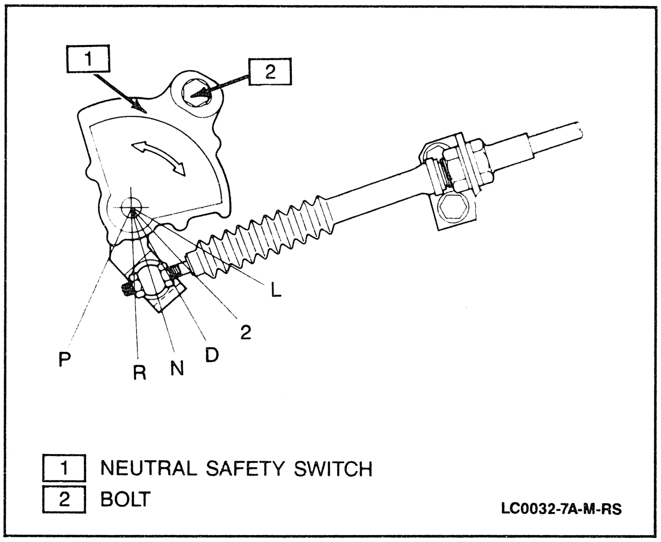

1
2
L
2
P
R
N
D
1 NEUTRAL SAFETY SWITCH
2 BOLT
LC0032-7A-M-RS

Figure 7A-32 Adjusting Shift Neutral Safety Position

NEUTRAL SAFETY SWITCH

Figures 7A-28 through 7A-29 and 7A-31 through 7A-32

Remove or Disconnect

1. Neutral safety switch couplers.
2. Neutral safety switch from transaxle.

Install or Connect

1. Neutral safety switch to transaxle.
2. Neutral safety switch couplers.

Adjust

1. Shift manual lever to "N" position.
2. Using flat head screwdriver, neutral safety switch joint clockwise or counterclockwise to the position shown and check that a "click" is heard from joint at this position (Figure 7A-31).
3. Neutral safety switch by hand in arrow direction as shown (Figure 7A-32). Stop at the position where a "click" is heard from joint.

Tighten

- Neutral safety switch bolt to 23 N·m (17 lb. ft.).

3. Neutral safety switch couplers and clamp.

Important

- Upon completion of neutral safety switch installation, perform the following steps to ensure proper operation.
  a. Apply parking brake and block wheels.
  b. With selector lever shifted to "P" position, turn ignition switch to "START" and check that the starter motor operates.
  c. Shift selector lever from "P" to "N" range, turn ignition switch to "START" and check that the starter motor operates.
  d. Shift selector lever from "N" to "L" and then back to "N" position, turn ignition switch to "START" and check that the starter motor operates.
  e. Shift selector lever from "N" to "P" range and check starter motor for operation as in step d.
  f. Check to make sure that in any other range than "P" and "N," starter motor does not operate when ignition switch is turned to "START."
  g. Turn ignition switch "ON" and shift selector lever to "R" position and check backup lamp operation.

TRANSAXLE ASSEMBLY

Figures 7A-33 through 7A-37

Important

- When removing transaxle assembly from engine, move it parallel to crankshaft and use care not to apply excessive force to drive plate and torque converter. After removing transaxle assembly, be sure that oil pan is kept at the bottom. If transaxle is tilted, transaxle fluid may leak out.

Remove or Disconnect

1. Air suction guide from air cleaner. Refer to DRIVEABILITY AND EMISSIONS (SEC.6E).
2. Battery negative (-) cable.

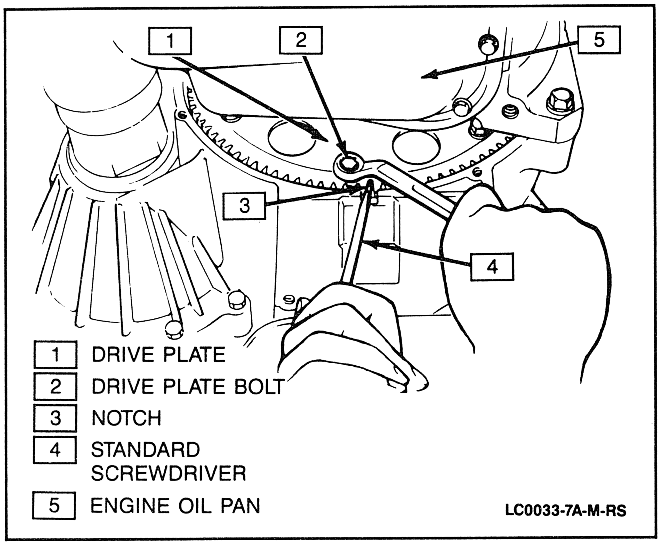


Figure 7A-33 Removing Drive Plate Bolts

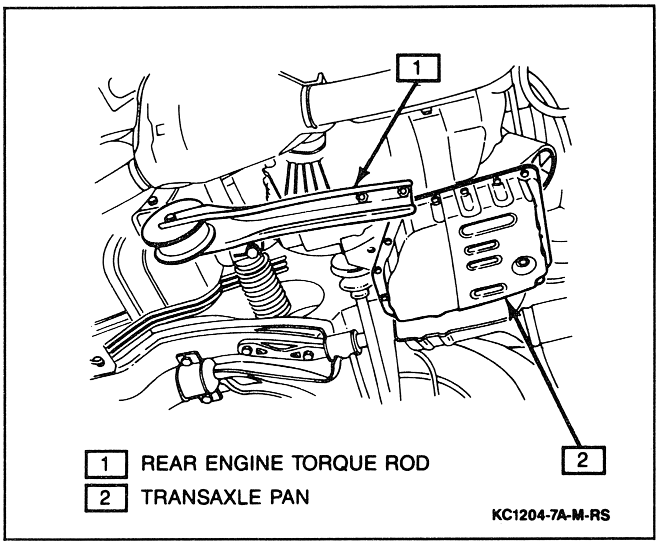


Figure 7A-34 Rear Engine Torque Rod

3. Battery positive (+) cable.
4. Battery and battery bracket (tray).
5. Battery negative (-) cable at transaxle.
6. Solenoid wire coupler, speed sensor and neutral safety switch wire couplers.
7. Wire harness from transaxle.
8. Speedometer cable from transaxle.
9. Oil pressure control cable from accelerator cable, and then, accelerator cable from transaxle.
10. Select cable from transaxle.
11. Starter motor. Refer to CRANKING SYSTEM (SEC.6D2).
12. Oil outlet and inlet hoses from oil pipes.
13. Plug the two oil hoses to prevent fluid in hoses and oil cooler from draining.

- Raise and suitably support vehicle. Refer to GENERAL INFORMATION (SEC.0A).

14. Exhaust No. 1 pipe.
15. Clutch housing lower plate.
16. Six drive plate bolts. To lock drive plate, engage a screwdriver with the drive plate gear through

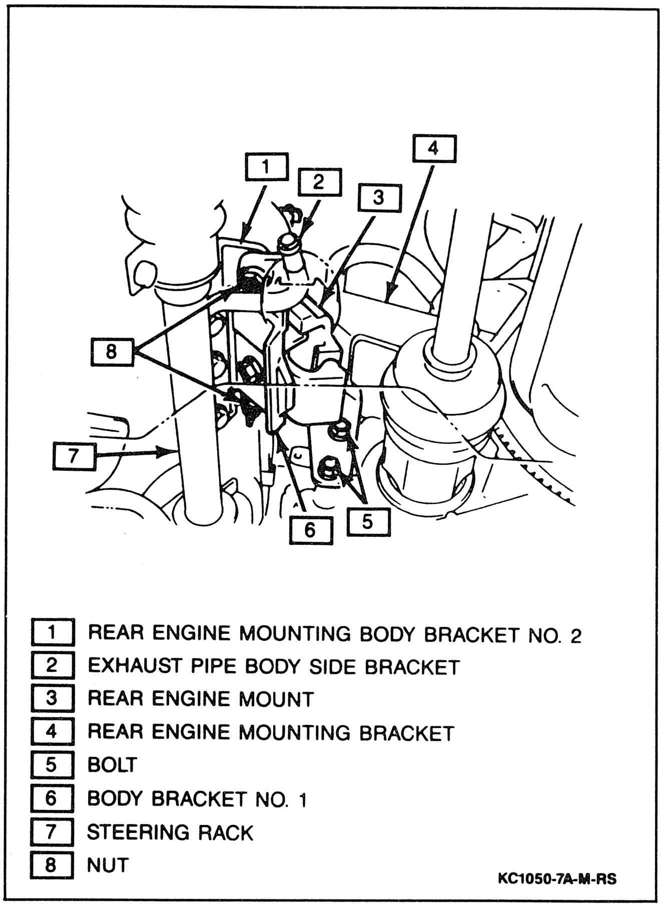

1
2
3
4
8
7
6
5
1 REAR ENGINE MOUNTING BODY BRACKET NO. 2
2 EXHAUST PIPE BODY SIDE BRACKET
3 REAR ENGINE MOUNT
4 REAR ENGINE MOUNTING BRACKET
5 BOLT
6 BODY BRACKET NO. 1
7 STEERING RACK
8 NUT
KC1050-7A-M-RS

Figure 7A-35 Rear Engine Mount

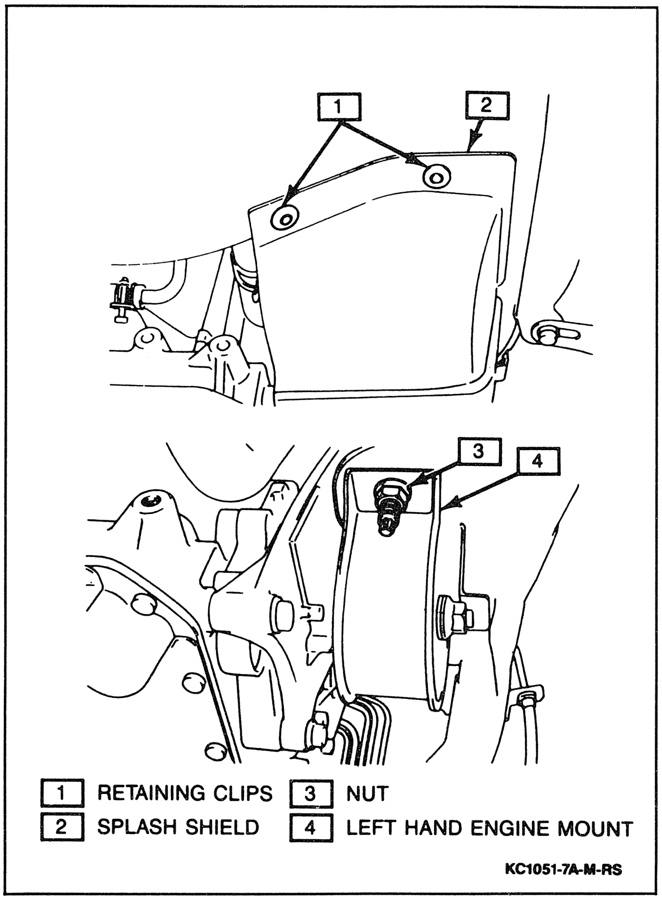

1
2
3
4
1 RETAINING CLIPS
2 SPLASH SHIELD
3 NUT
4 LEFT HAND ENGINE MOUNT
KC1051-7A-M-RS

Figure 7A-36 Left Hand Engine Mount

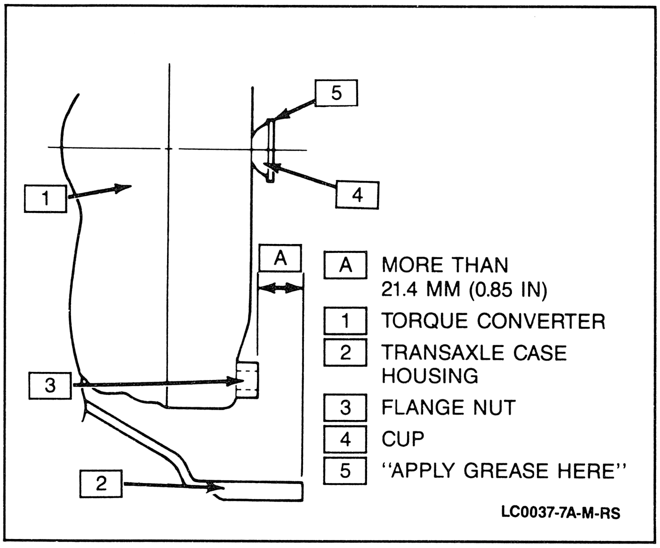

5
4
1
A
3
2
A MORE THAN 21.4 MM (0.85 IN)
1 TORQUE CONVERTER
2 TRANSAXLE CASE HOUSING
3 FLANGE NUT
4 CUP
5 "APPLY GREASE HERE"
LC0037-7A-M-RS

Figure 7A-37 Torque Converter Installation

the notch provided at under side of transaxle case (Figure 7A-34).

17. LH front drive axle. Refer to DRIVE AXLE & AXLE SHAFT (SEC.4D).
18. Detach the inboard joint of RH drive axle from differential. Refer to DRIVE AXLE & AXLE SHAFT (SEC.4D).
19. Rear engine torque rod and bracket from transaxle (Figure 7A-34).

Important

- Securely support the transaxle with a suitable jack before removing.

20. Rear engine mounting bracket assembly from body (Figure 7A-35).
21. Splash cover.
22. Left hand engine mount (Figure 7A-36).
23. Bolts fastening the engine and transaxle.
24. Disconnect the transaxle from engine by sliding towards the left side, and then carefully lower the jack.

Important

1. Before installing transaxle assembly:
    a. Apply grease around the cup at center of torque converter (Figure 7A-37).
    b. Measure the distance A shown in Figure 7A-37. The distance should be more than 21.3 mm (0.85 in.). If it is less than 21.4 mm (0.85 in.), the torque converter is improperly installed. Remove the torque converter and reinstall it correctly.
2. When installing transaxle, guide the right drive axle into differential side gear as the transaxle is being raised.
3. After inserting the inboard joints of (RH) and (LH) drive axles into differential side gears, push the inboard joints into side gears until the snap rings on drive axles engage side gears. Refer to DRIVE AXLE & AXLE SHAFT (SEC.4D).

4. After connecting oil pressure control cable to accelerator cable, check oil pressure control cable play and adjust if necessary. Refer to "Oil Pressure Control Cable" earlier in this section.
5. Install select cable. Refer to "Select Cable" procedure earlier in this section.
6. Refill transaxle and check fluid level. Refer to "Fluid Change" procedure earlier in this section.

→← Install or Connect

1. Transaxle to engine by raising transaxle to engine using a floor jack.
2. Bolts and nuts fastening the transaxle to engine.

Tighten

- Bolts and nuts to 55 N·m (40 lb.ft.).

3. Left hand engine mount (Figure 7A-36).
4. Splash cover.
5. Rear engine mounting bracket assembly to body (Figure 7A-35).
6. Rear engine torque rod and bracket to transaxle (Figure 7A-34).
7. Inboard joint of RH drive axle to differential. Refer to DRIVE AXLE & AXLE SHAFT (SEC. 4D).
8. LH front drive axle. Refer to DRIVE AXLE & AXLE SHAFT (SEC.4D).
9. Six drive plate bolts to lock drive plate, engage a screwdriver with the drive plate gear through the notch provided at under side of transaxle case (Figure 7A-33).

Tighten

- Drive plate bolts to 19 N·m (14 lb.ft.).

10. Clutch housing lower plate.
11. Exhaust No. 1 pipe.
12. Two oil hoses.

- Lower vehicle.

13. Oil outlet and inlet hoses to oil pipes.
14. Starter motor. Refer to CRANKING SYSTEM (SEC.6D2).
15. Select cable to transaxle. Refer to "Select Cable" procedure earlier in this section.
16. Oil pressure control cable to accelerator cable, and accelerator cable to transaxle. Refer to "Oil Pressure Control Cable" earlier in this section.
17. Speedometer cable to transaxle.
18. Wire harness from transaxle.
19. Solenoid wire, speed sensor and neutral safety switch wire couplers.
20. Negative (-) cable at transaxle.
21. Battery and battery bracket (tray).
22. Battery positive (+) cable.
23. Battery negative (-) cable.
24. Air suction guide to air cleaner. Refer to DRIVEABILITY AND EMISSIONS (SEC.6E).

SPECIFICATIONS

FASTENER TORQUES

Transaxle Drain Plug	23 N·m (16.5 lb.ft.)
Oil Pan Bolts	6 N·m (53 lb.in.)
Oil Strainer Bolts	6 N·m (53 lb.in.)
Stoplamp Switch Lock Nut	15 N·m (10.5 lb.ft.)
Neutral Safety Switch Bolt	23 N·m (17 lb.ft.)
Transaxle Mounting Bolts and Nuts	55 N·m (40 lb.ft.)
Drive Plate Bolts	19 N·m (14 lb.ft.)

SECTION 7A1

UNIT REPAIR

CONTENTS

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    Oil Pump 7A1-52
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    Counter Shaft and Output Shaft Bearings 7A1-59
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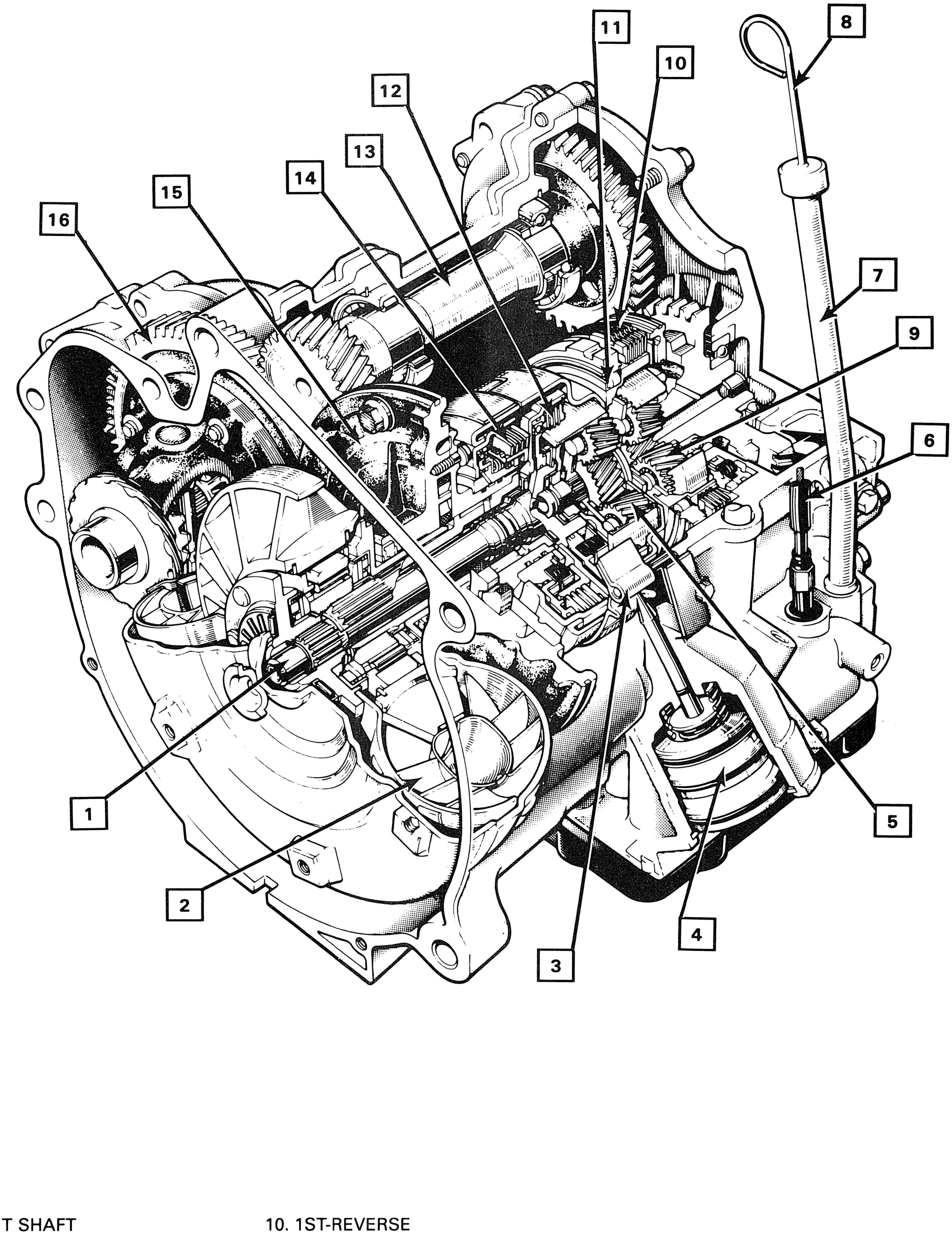
SPECIAL TOOLS 7A1-86

GENERAL DESCRIPTION

The automatic transaxle consists of the hydraulic torque converter, electronically controlled 3-speed automatic transaxle, countershaft and differential.

The transaxle consists of 2 planetary gears, 2 disc clutches, 1 band brake, 1 disc brake and 1 one-way clutch. Its operation is controlled by selecting a position from 6 positions ("P", "R", "N", "D", "2" and "L") manually by means of the selector lever installed in the passenger compartment.

In the "D" or "2" range, the gear ratio is changed for the 1st, 2nd or 3rd speed ("D" range only) automatically by electronic control.



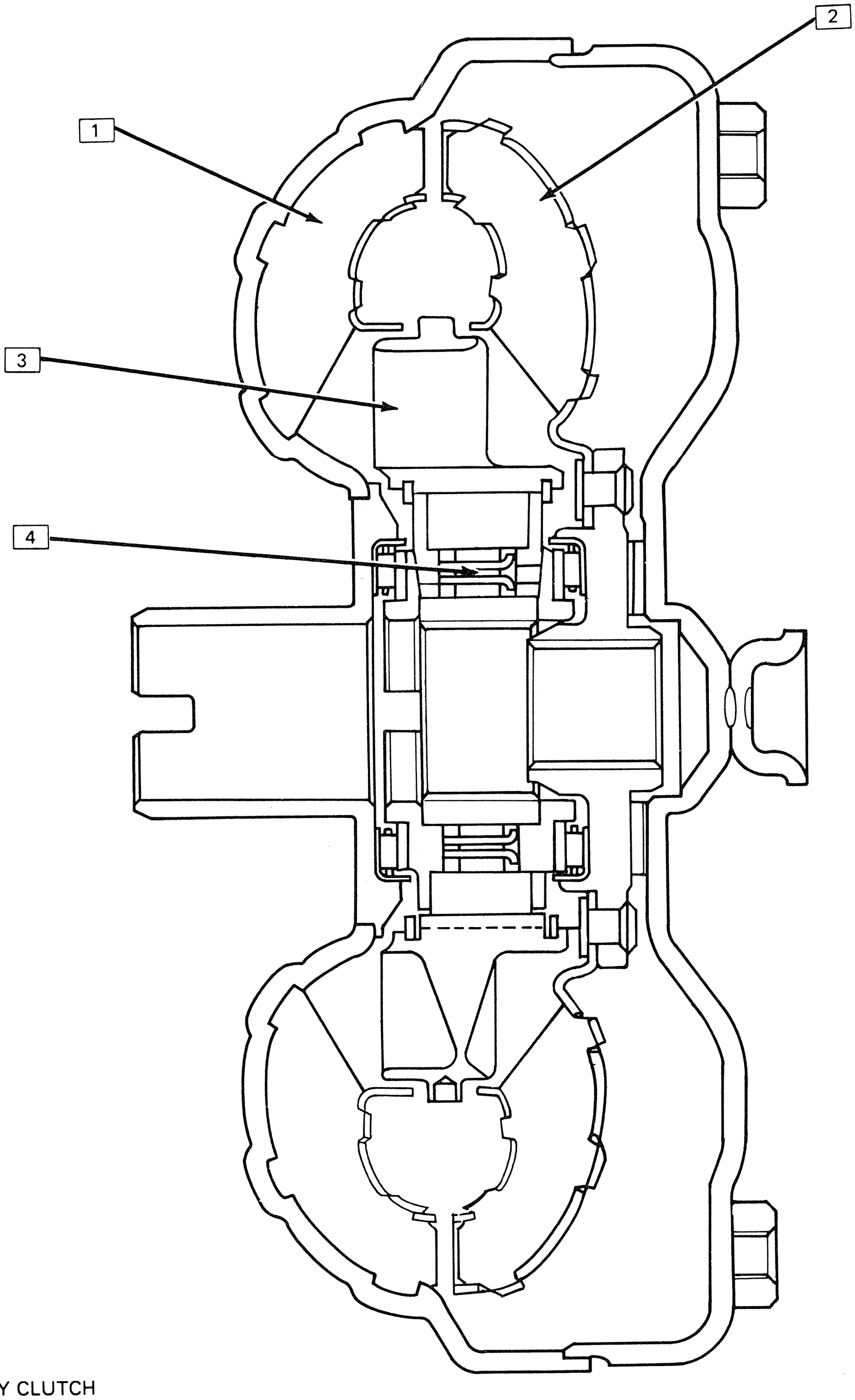
1. INPUT SHAFT
2. TORQUE CONVERTER
3. SECOND BRAKE BAND
4. SECOND BRAKE PISTON
5. FRONT PLANETARY GEAR
6. OIL PRESSURE CONTROL CABLE
7. OIL FILLER TUBE
8. OIL LEVEL GAUGE
9. REAR PLANETARY GEAR
10. 1ST-REVERSE BRAKE
11. ONE-WAY CLUTCH
12. FORWARD CLUTCH
13. COUNTER SHAFT
14. DIRECT CLUTCH
15. OIL PUMP
16. DIFFERENTIAL

Figure 7A1-1 Automatic Transaxle Construction

TORQUE CONVERTER

The torque converter is a 3-element hydraulic type and consists of the pump, turbine and stator in a unit incapable of disassembly. The pump is mounted to the crankshaft, the turbine to the input shaft and the stator to the transaxle case by way of the one-way clutch.

The torque converter, which increases torque when starting, accelerating and up-hill driving, functions as a fluid clutch while driving at a constant speed.



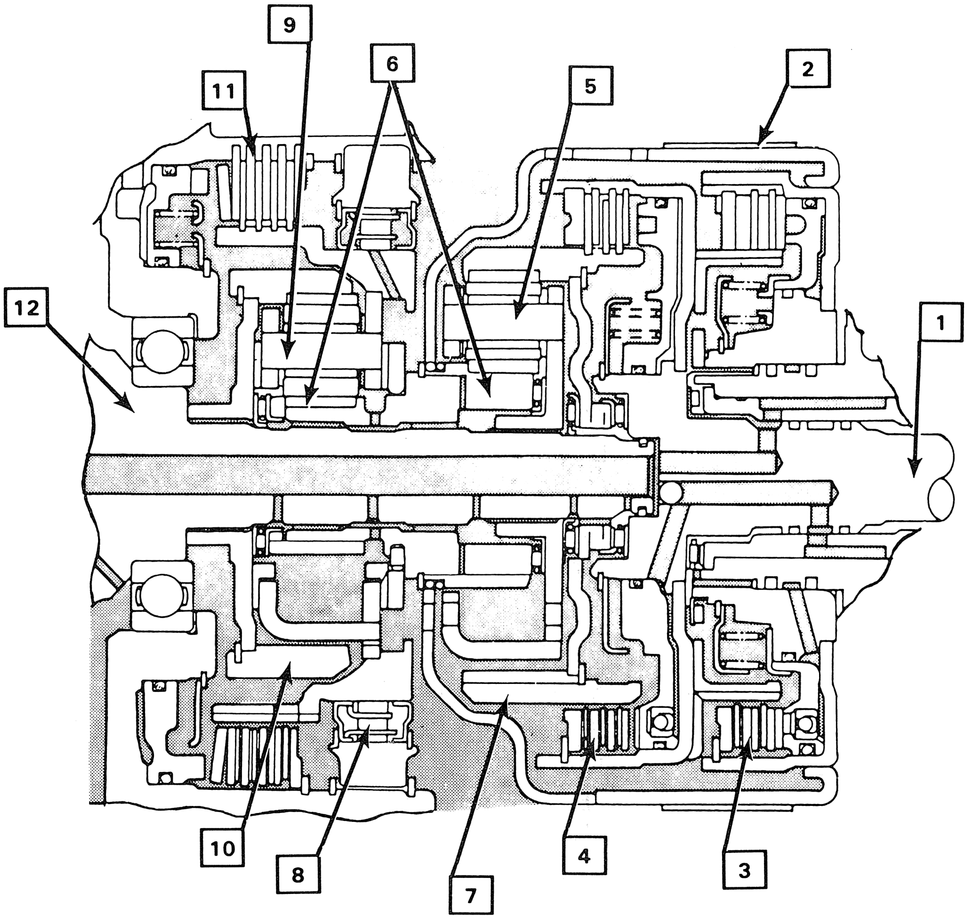
1. PUMP
2. TURBINE
3. STATOR
4. ONE-WAY CLUTCH

Figure 7A1-2 Torque Converter Cross Section

PLANETARY GEAR UNITS

In this unit, the sun gear is mounted in its center and engaged with it are 4 pinion gears supported by a carrier. Then, the outer ring gear is engaged with them. Depending on gear combinations, revolution is changed in speed or direction.

Among the units which operate in connection with the planetary gear unit, there are a direct clutch, a second brake, a forward clutch, a one-way clutch and a 1st-reverse brake.

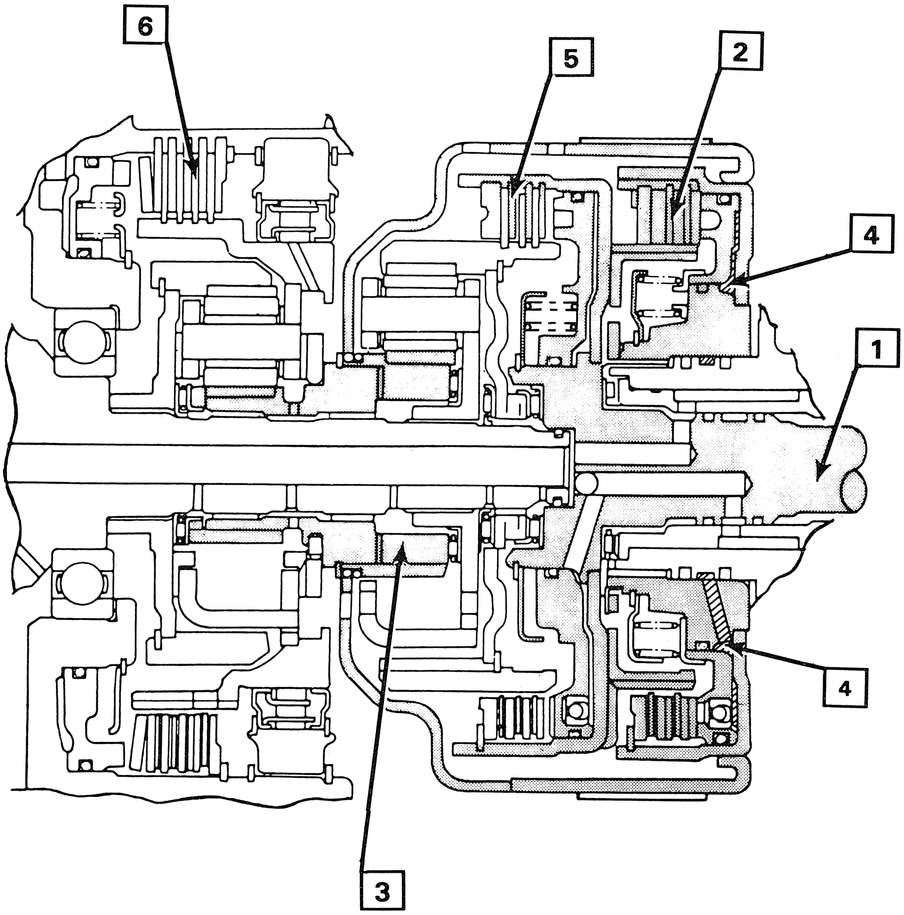


1. INPUT SHAFT
2. SECOND BRAKE BAND
3. DIRECT CLUTCH
4. FORWARD CLUTCH
5. FRONT PLANETARY GEAR
6. SUN GEAR
7. FRONT RING GEAR
8. ONE-WAY CLUTCH
9. REAR PLANETARY GEAR
10. REAR RING GEAR
11. 1ST REVERSE BRAKE
12. OUTPUT SHAFT

Figure 7A1-3 Planetary Gear Set Cross Section

DIRECT CLUTCH

The direct clutch connects the input shaft and the sun gear (common to both front and rear planetary gear units). It operates at the 3rd gear in the "D" range and in the "R" range. At the same time, the forward clutch operates in the former and the 1st-reverse brake in the later.



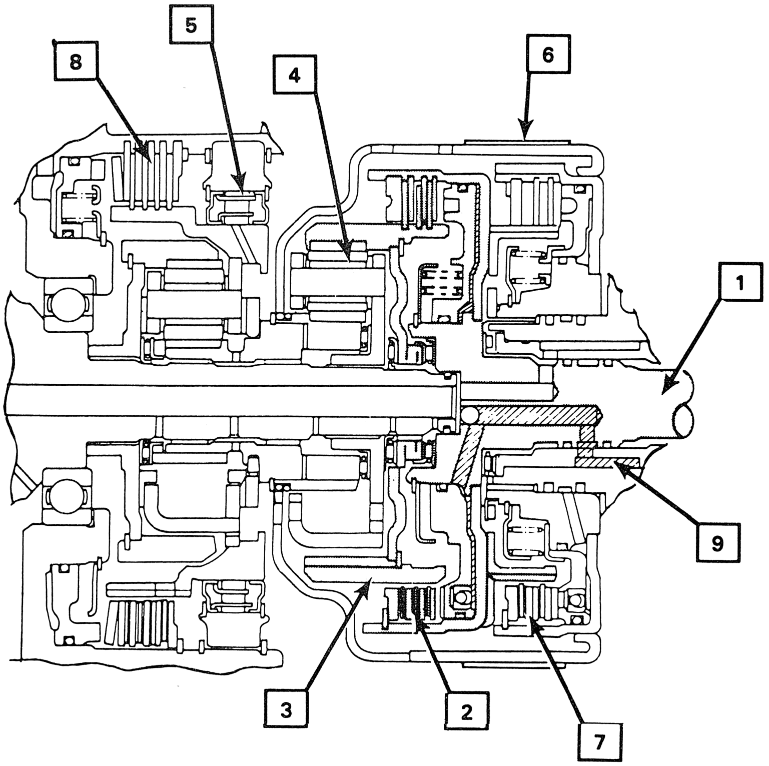
1. INPUT SHAFT
2. DIRECT CLUTCH
3. SUN GEAR
4. OIL PRESSURE
5. FORWARD CLUTCH
6. 1ST REVERSE BRAKE

Figure 7A1-4 Direct Clutch Cross Section

FORWARD CLUTCH

The forward clutch connects the input shaft and ring gear of the front planetary gear. It operates in the ranges other than "P", "R" and "N". The units which operate simultaneously with the forward clutch are as follows:

- One-way clutch at the first gear in "D" or "2" range.
- Second brake at the 2nd gear in "D" or "2" range.
- Direct clutch at the 3rd gear in "D" range.
- 1st-reverse brake at the 1st gear in "L" range.

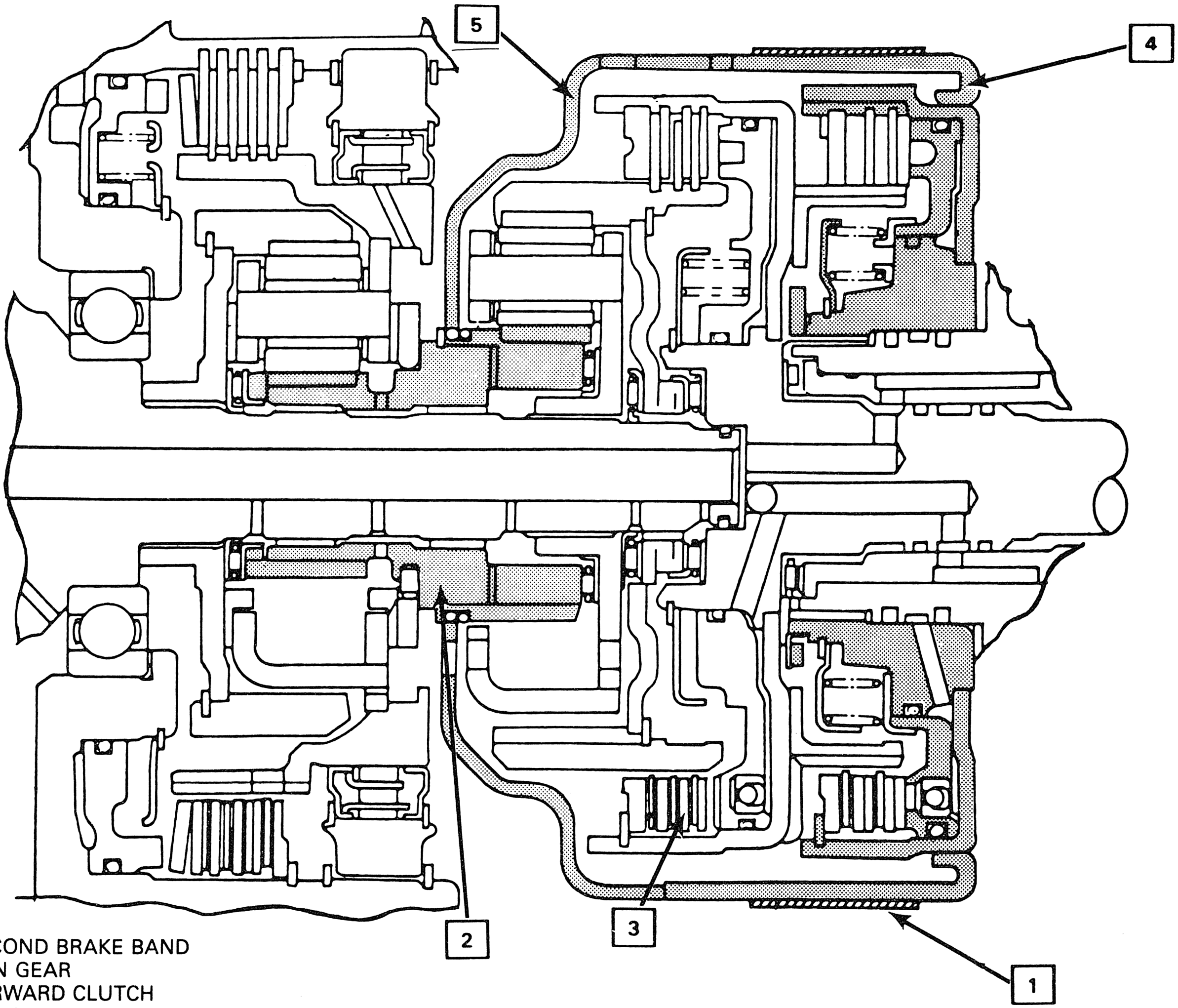


1. INPUT SHAFT
2. FORWARD CLUTCH
3. RING GEAR OF FRONT PLANETARY GEAR
4. FRONT PLANETARY GEAR
5. ONE-WAY CLUTCH
6. SECOND BRAKE BAND
7. DIRECT CLUTCH
8. 1ST-REVERSE BRAKE
9. OIL PRESSURE

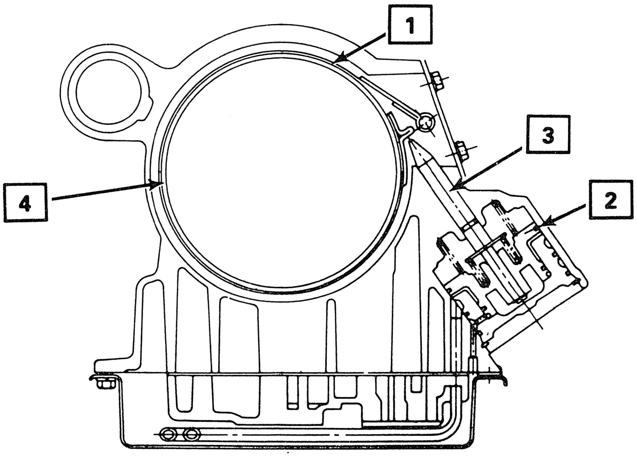
Figure 7A1-5 Forward Clutch Cross Section

SECOND BRAKE

The second brake is of a band type. It holds the sun gear of the front and rear planetary gear units stationary. It operates at the 2nd gear in "D" or "2" range simultaneously with the forward clutch.



1. SECOND BRAKE BAND
2. SUN GEAR
3. FORWARD CLUTCH
4. DIRECT CLUTCH DRUM
5. SUN GEAR INPUT DRUM

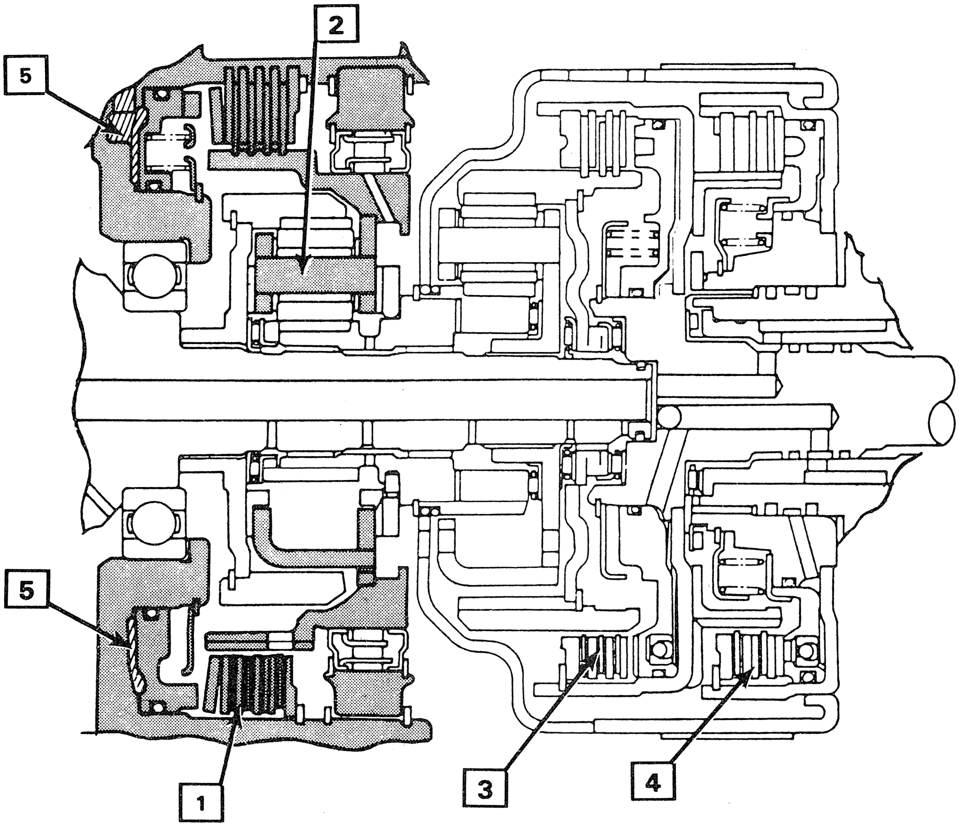


1. SECOND BRAKE BAND
2. SECOND BRAKE PISTON
3. SECOND BRAKE PISTON ROD
4. DIRECT CLUTCH DRUM

Figure 7A1-6 Second Brake and Brake Piston Cross Section

FIRST AND REVERSE BRAKE

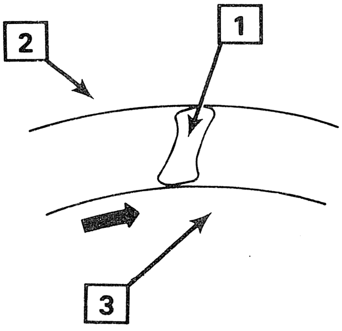
The 1st-reverse brake holds the rear planetary carrier stationary. It operates in "L" or "R" range. At the same time, the forward clutch operates in "L" range and the direct clutch in "R" range.



1. 1ST-REVERSE BRAKE
2. REAR PLANETARY CARRIER
3. FORWARD CLUTCH
4. DIRECT CLUTCH
5. OIL PRESSURE

ONE-WAY CLUTCH

The sprag type one-way clutch is used between the rear planetary carrier and the transmission case. It consists of a one-way clutch race, sprags and a retainer, and the one-way clutch race is mounted to the transaxle case. When the rear planetary carrier is in motion to turn to the arrow mark side at the first gear in "D" or "2" range, the sprags stick between carrier and race, and prevent the planetary carrier from turning reversely (to arrow mark side).



1. SPRAG
2. ONE-WAY CLUTCH RACE (FIXED TO THE TRANS. CASE)
3. REAR PLANETARY CARRIER

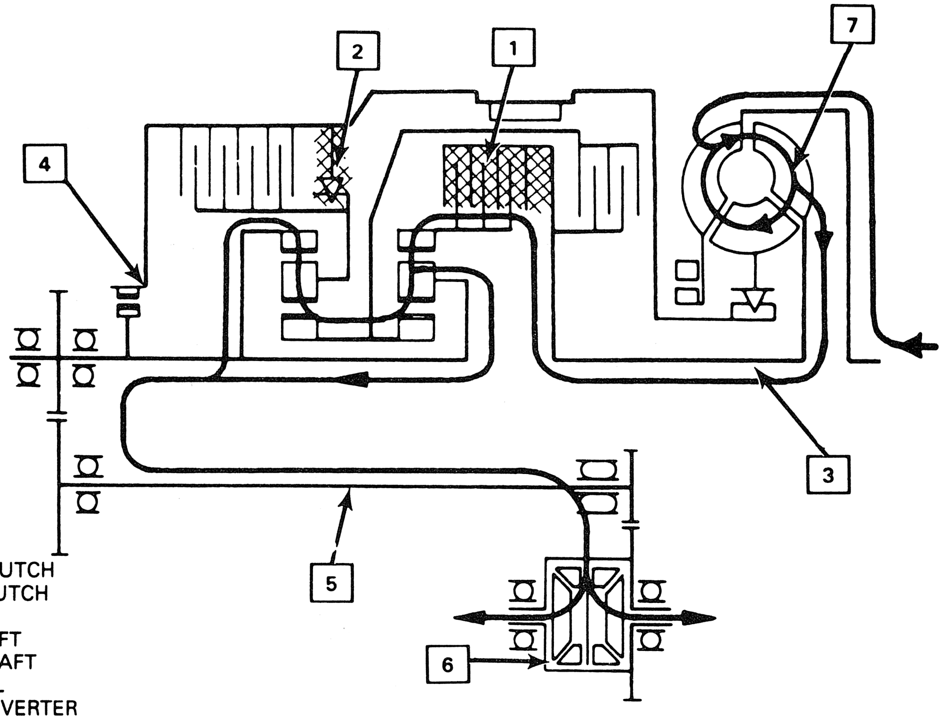
Figure 7A1-7 First and Reverse Brake Cross Section and One-Way Clutch

1ST GEAR IN "D" OR "2" RANGE

As oil pressure is applied to the forward clutch, the input shaft and the front planetary ring gear are engaged. This allows the clockwise revolution of the input shaft to be transmitted directly to the ring gear and then through the front planetary carrier to the output shaft.

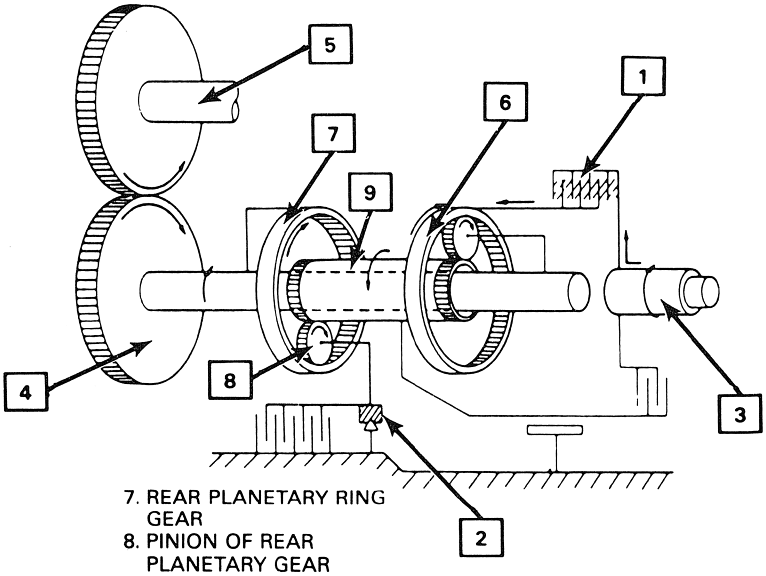
On the other hand, the sun gear which is engaged with the pinion gears of the front planetary gear turns counterclockwise. As this revolution is transmitted to the pinions of the rear planetary gear, the rear planetary carrier would also turn counterclockwise. However, being held by the one-way clutch, it cannot turn. Consequently, the pinions turn clockwise on their axes and this causes the ring gear of the rear planetary gear and output shaft to turn clockwise.

POWER FLOW OF 1ST GEAR IN "D" OR "2" RANGE (1)



1. FORWARD CLUTCH
2. ONE-WAY CLUTCH
3. INPUT SHAFT
4. OUTPUT SHAFT
5. COUNTER SHAFT
6. DIFFERENTIAL
7. TORQUE CONVERTER

POWER FLOW OF 1ST GEAR IN "D" OR "2" RANGE (2)



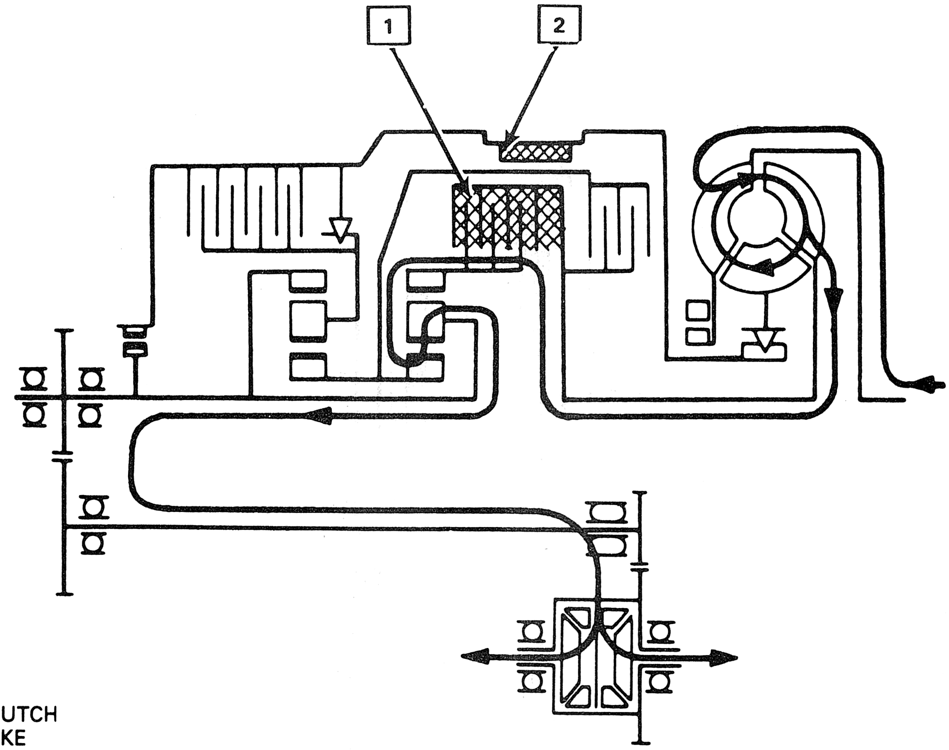
1. FORWARD CLUTCH
2. ONE-WAY CLUTCH
3. INPUT SHAFT
4. OUTPUT SHAFT
5. COUNTER SHAFT
6. FRONT PLANETARY RING GEAR
7. REAR PLANETARY RING GEAR
8. PINION OF REAR PLANETARY GEAR
9. SUN GEAR

Figure 7A1-8 Power Flow of 1st Gear in "D" or "2" Range (1) and (2)

2ND GEAR IN "D" OR "2" RANGE

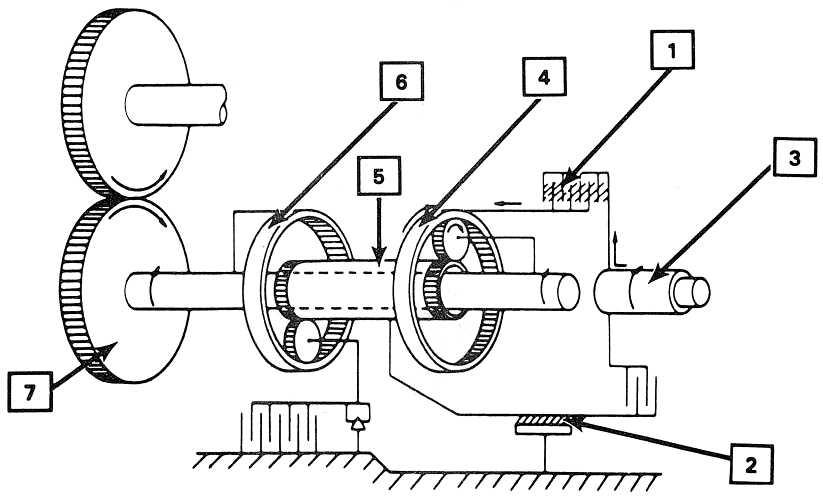
As oil pressure is applied to the forward clutch, the input shaft and the ring gear of the front planetary gear are engaged. This allows the revolution of the input shaft to be transmitted directly to the ring gear, causing the front planetary carrier to turn clockwise. In this state, the sun gear, being engaged with the pinions of the front planetary gear, would turn counterclockwise. However, the second brake is in operation and prevents it from turning. As a result, the pinions of the front planetary gear turn around the sun gear. Therefore, the front planetary ring gear and then the output shaft turn clockwise.

POWER FLOW OF 2ND GEAR IN "D" OR "2" RANGE (1)



1. FORWARD CLUTCH
2. SECOND BRAKE

POWER FLOW OF 2ND GEAR IN "D" OR "2" RANGE (2)



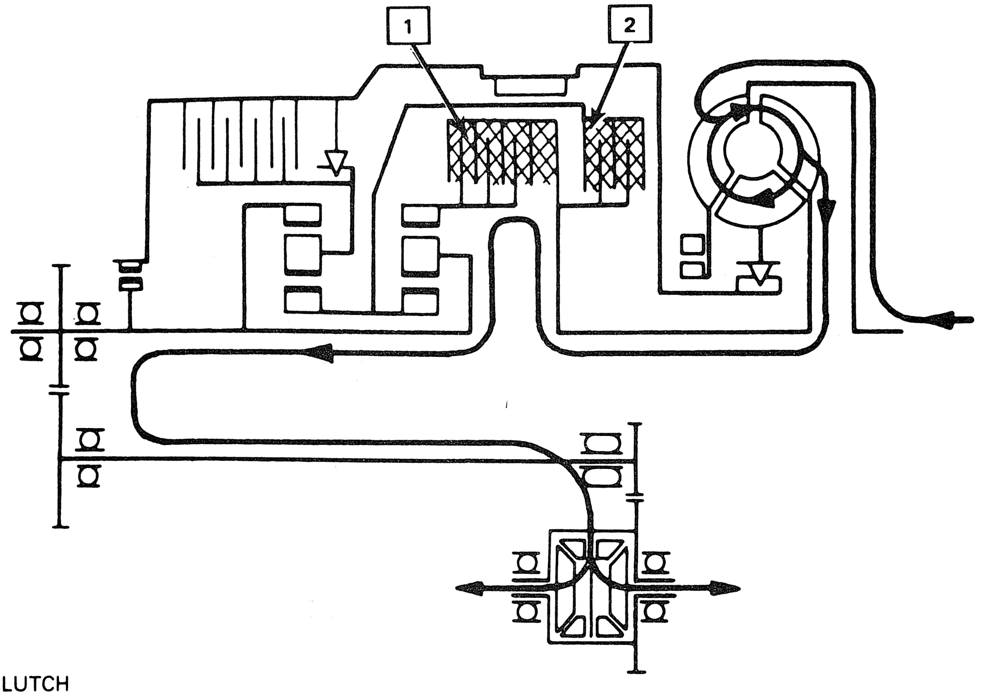
1. FORWARD CLUTCH
2. SECOND BRAKE
3. INPUT SHAFT
4. FRONT PLANETARY RING GEAR
5. SUN GEAR
6. REAR PLANETARY RING GEAR
7. OUTPUT SHAFT

Figure 7A1-9 Power Flow of 2nd Gear in "D" or "2" Range (1) and (2)

3RD GEAR IN "D" RANGE

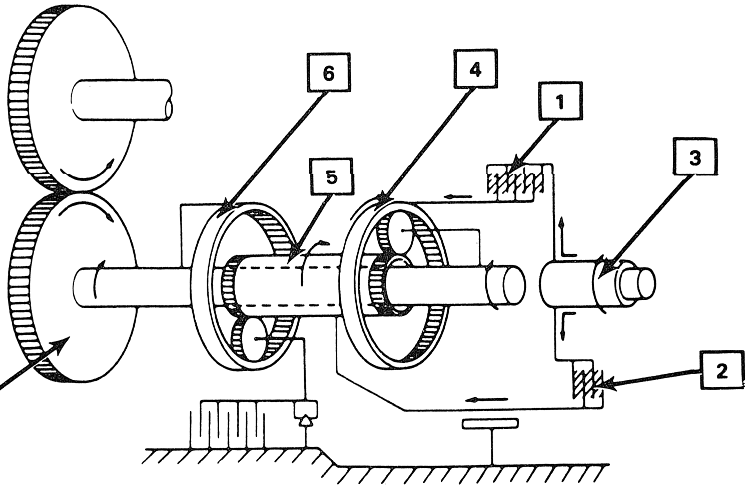
As oil pressure is applied to the forward clutch and the direct clutch, the input shaft is engaged with the ring gear and the sun gear of the front planetary gear. In other words, the input shaft is directly connected to the planetary gear unit itself. As a result, the pinions of the planetary gear are locked and thus the input shaft revolution is transmitted directly to the output shaft.

POWER FLOW OF 3RD GEAR IN "D" RANGE (1)



1. FORWARD CLUTCH
2. DIRECT CLUTCH

POWER FLOW OF 3RD GEAR IN "D" RANGE (2)



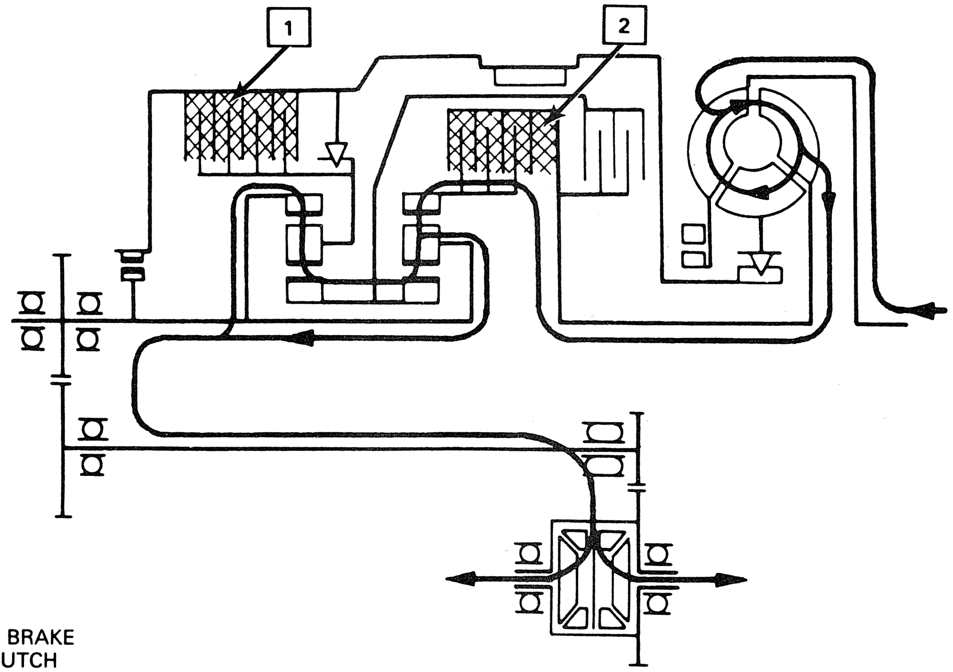
1. FORWARD CLUTCH
2. DIRECT CLUTCH
3. INPUT SHAFT
4. FRONT PLANETARY RING GEAR
5. SUN GEAR
6. REAR PLANETARY RING GEAR
7. OUTPUT SHAFT

Figure 7A1-10 Power Flow of 3rd Gear in "D" Range (1) and (2)

"L" RANGE

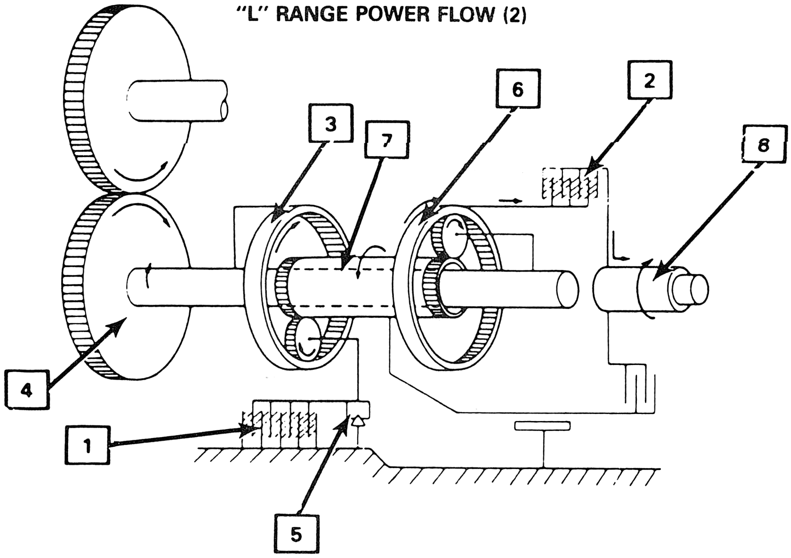
The torque flow from the engine is the same as at the 1st gear in "D" or "2" range, but in this range, the 1st-reverse brake is put into operation to prevent the rear planetary carrier from clockwise revolution which occurs when engine brake is applied. In other words, when driving in "D" or "2" range, the counterclockwise revolution of the rear planetary carrier is stopped by means of the one-way clutch, but when the engine brake is applied the torque (clockwise) from the output shaft acts to prevent the one-way clutch from operating and the rear planetary carrier idles. This puts the 1st-reverse brake into operation so as to hold the rear planetary carrier stationary. Thus an engine braking force is provided.

"L" RANGE POWER FLOW (1)



1. 1ST-REVERSE BRAKE
2. FORWARD CLUTCH

"L" RANGE POWER FLOW (2)



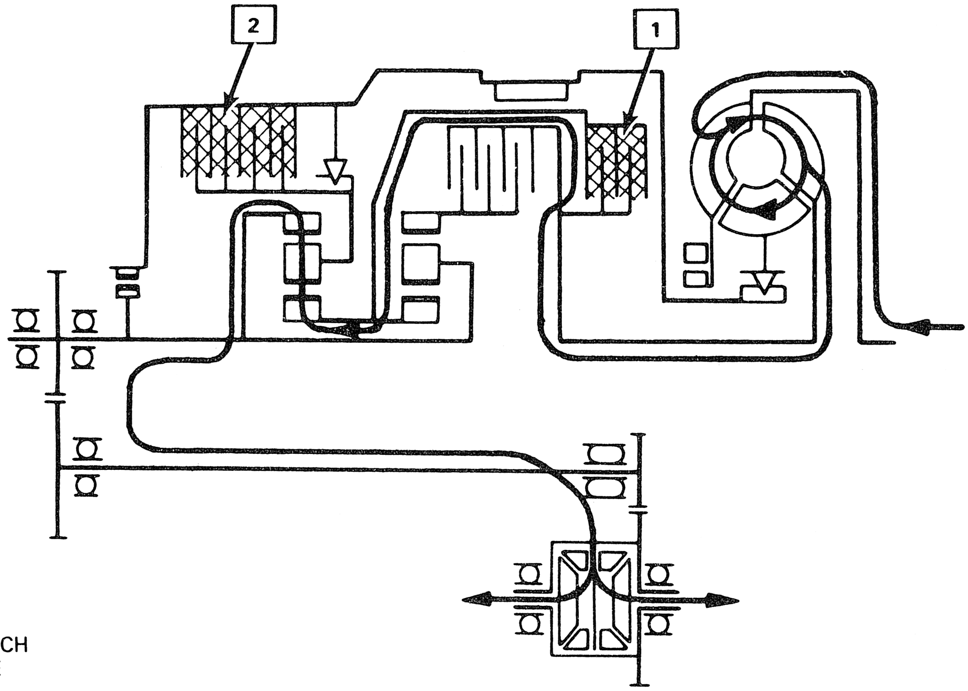
1. 1ST-REVERSE BRAKE
2. FORWARD CLUTCH
3. REAR PLANETARY RING GEAR
4. OUTPUT SHAFT
5. ONE-WAY CLUTCH
6. FRONT PLANETARY RING GEAR
7. SUN GEAR
8. INPUT SHAFT

Figure 7A1-11 "L" Range Power Flow (1) and (2)

"R" RANGE

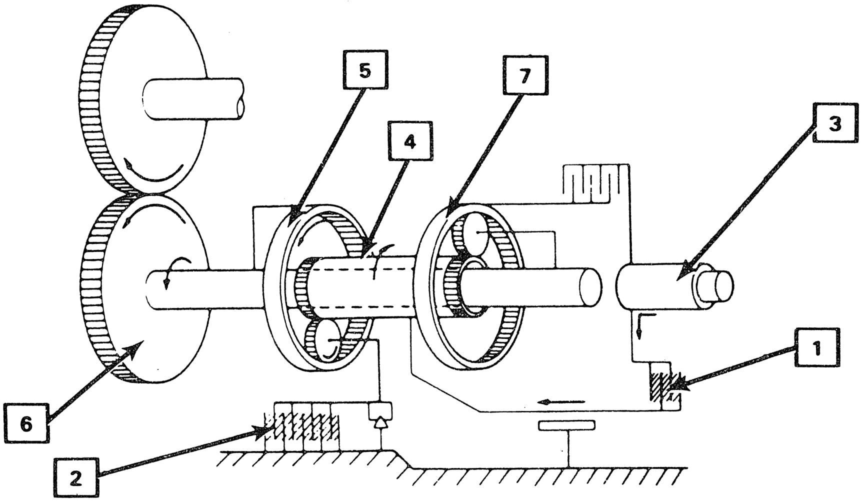
As oil pressure is applied to the direct clutch, the input shaft is engaged with the sun gear of the planetary gear. This allows the torque to be transmitted directly from the input shaft to the sun gear. On the other hand, the 1st-reverse brake is also at work and therefore the rear planetary carrier is held stationary. In this state, the pinions do not turn around the sun gear but turn around counterclockwise on their axes and cause the ring gear to turn counterclockwise. As the output shaft is spline fitted to the rear planetary ring gear, it also turns counterclockwise, thereby the car moves rearward.

"R" RANGE POWER FLOW (1)



1. DIRECT CLUTCH
2. 1ST-REVERSE BRAKE

"R" RANGE POWER FLOW (2)

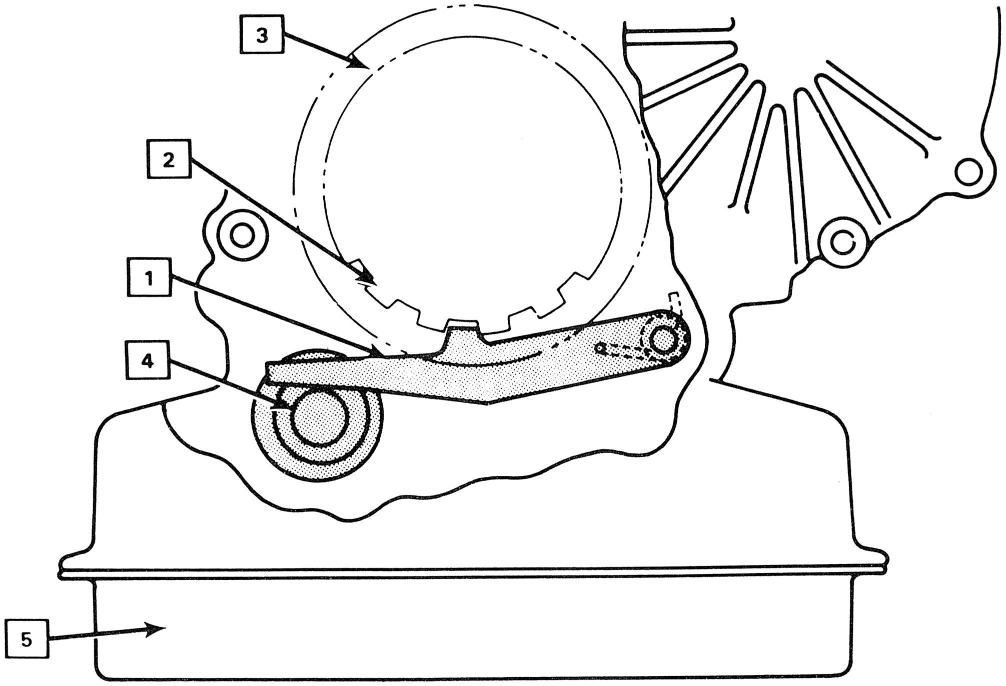


1. DIRECT CLUTCH
2. 1ST-REVERSE BRAKE
3. INPUT SHAFT
4. SUN GEAR
5. REAR PLANETARY RING GEAR
6. OUTPUT SHAFT
7. FRONT PLANETARY RING GEAR

Figure 7A1-12 "R" Range Power Flow (1) and (2)

"N" or "P" RANGE

As the forward clutch and direct clutch are released, the engine torque is not transmitted from the input shaft to the output shaft. In "P" range, the parking lock pawl is engaged with the parking lock gear which is incorporated with the drive gear of the output shaft and thus the front wheels are mechanically locked.



"P" RANGE
1. PARKING LOCK PAWL
2. PARKING LOCK GEAR
3. OUTPUT SHAFT DRIVE GEAR
4. PARKING LOCK PAWL SLEEVE
5. OIL PAN

Components Operation Chart

Range	Gear	Forward Clutch	Direct Clutch	Second Brake	1st & Reverse Brake	One-way Clutch	Parking Lock Pawl
P	Parking	—	—		** ○	—	○
R	Reverse	—	○	—	○	—	—
N	Neutral	—	—	—	—	—	—
D	1st	○	—	—	—	○	—
	2nd	○	—	○	—	—	—
	3rd	○	○	—	—	—	—
2	1st	○	—	—	—	○	—
	2nd	○	—	○	—	—	—
L	1st	○	—	—	○	○	—
	2nd	○	—	○	—	—	—

○ Operated

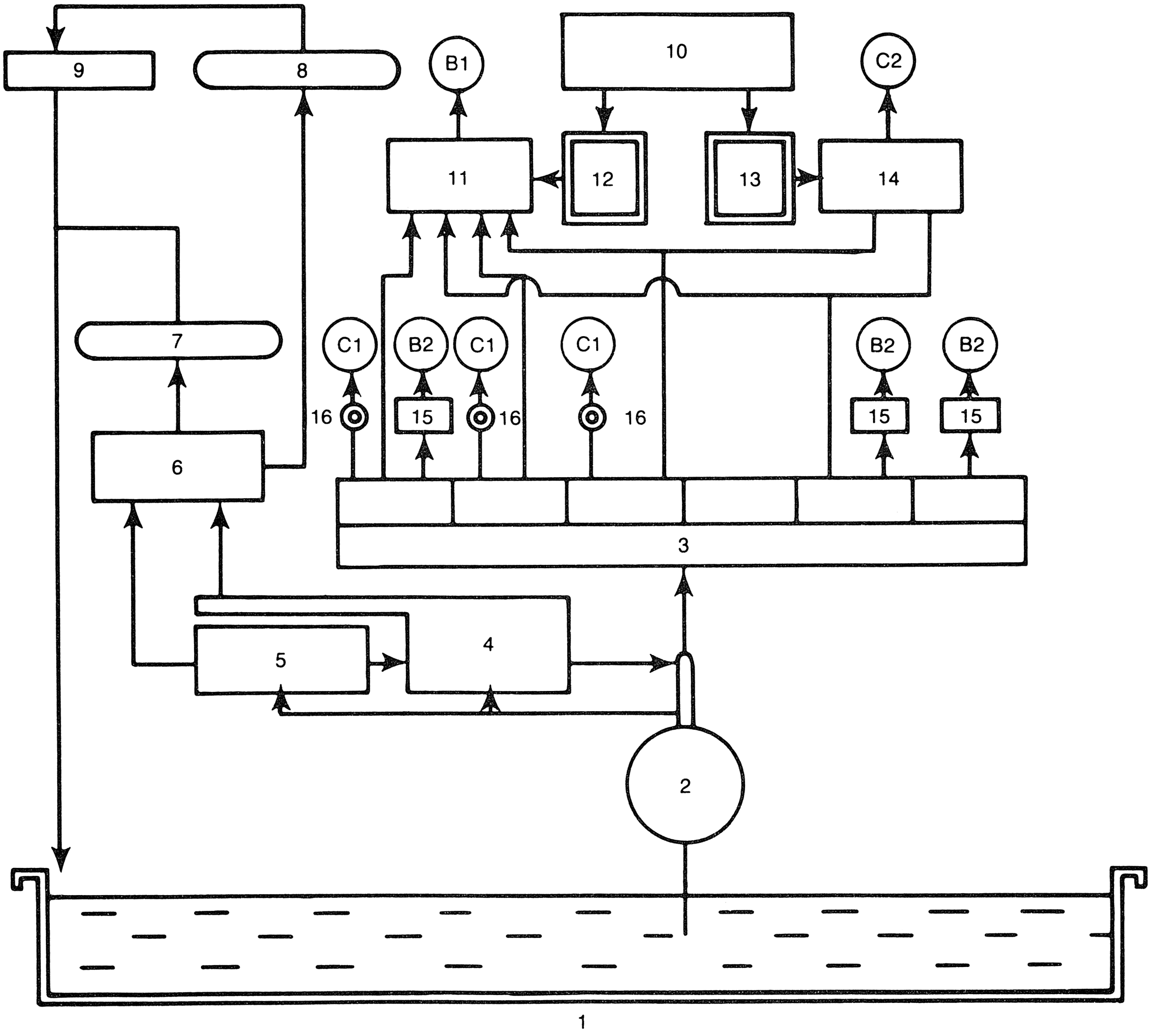
* To prevent overrevolution of engine, this 2nd gear is operated only when selector lever is shifted to "L" range at the speed of more than 55 km/h (34 mile/h)

* When engine is running

Figure 7A1-13 "N" or "P" Range and Components Operation Chart

OIL PRESSURE CONTROL SYSTEM

The oil pressure control system fundamentally consists of three parts: (1) oil pressure producing system which consists of an oil pump to produce oil pressure and regulator valve to regulate the pressure, (2) oil circuit to feed oil into the torque converter, the oil cooler and the transmission components to be lubricated, and (3) control system to shift the gear of the planetary gear unit by acting on each clutch and brake.



1. OIL PAN
2. OIL PUMP
3. MANUAL VALVE
4. PRIMARY REGULATOR VALVE
5. THROTTLE VALVE
6. SECONDARY REGULATOR VALVE
7. LUBRICATION
8. TORQUE CONVERTER
9. OIL COOLER
10. CONTROLLER (COMPUTER)
11. 1-2 SHIFT VALVE
12. SECOND (2ND) BRAKE SOLENOID
13. DIRECT CLUTCH SOLENOID
14. 2-3 SHIFT VALVE
15. B2 CONTROL VALVE
16. ACCUMULATOR

C1. FORWARD CLUTCH
C2. DIRECT CLUTCH
B1. SECOND (2ND) BRAKE
B2. 1ST-REVERSE BRAKE

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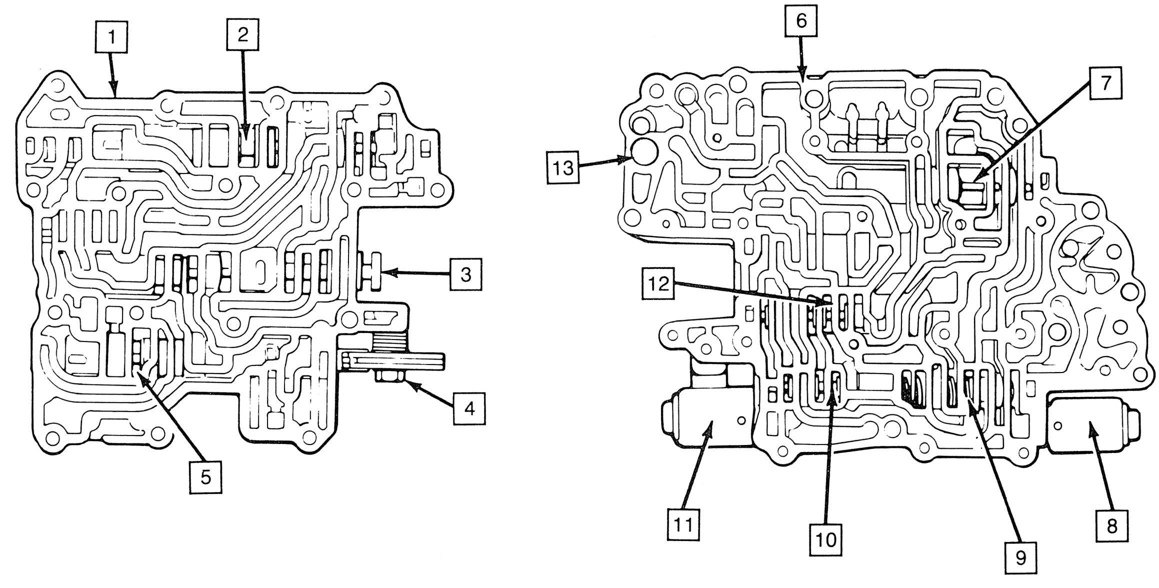
Figure 7A1-14 Oil Pressure Control System



1. UPPER VALVE BODY
2. PRIMARY REGULATOR VALVE
3. MANUAL VALVE
4. THROTTLE VALVE & VALVE CAM
5. THROTTLE VALVE
6. LOWER VALVE BODY
7. SECONDARY REGULATOR VALVE
8. DIRECT CLUTCH SOLENOID
9. 2-3 SHIFT VALVE
10. B2 CONTROL VALVE
11. 2ND BRAKE SOLENOID
12. 1-2 SHIFT VALVE
13. COOLER BY-PASS VALVE

Figure 7A1-15 Upper and Lower Valve Body

VALVE BODY

The valve body is found in the oil pan and has valves to control oil pressure to the various clutches and bands. In the valve body, oil passages connect the valves.

OIL PUMP

The oil pump is of the internal gear type. It feeds oil to the torque converter, lubricates each part of the transmission and delivers oil pressure to operate each clutch and brake solenoid. The oil pump is driven by the converter hub.

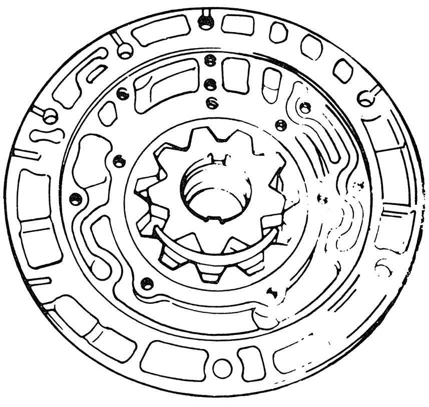
MANUAL VALVE

The manual valve is directly connected with the selector lever by a cable. It opens and closes the oil passage mechanically so as to form respective oil pressure circuits for "L", "2", "D", "N", "R", or "P" range according to the selector lever movement.

THROTTLE VALVE

As the throttle valve is linked with the accelerator pedal by cable, it produces the throttle pressure corresponding to the extent the accelerator pedal is depressed which is directly related to the engine output.

When the accelerator pedal is depressed, the throttle cam pushes the shift plug which then compresses two springs to move the throttle valve. Thus the line pressure passage is opened and the throttle pressure is produced. The throttle pressure is also applied to the back of the throttle valve to push back the valve. The throttle pressure is determined by the spring pressure of the springs (position of the shift plug) and applied to the primary and secondary regulator valves to regulate the line pressure.

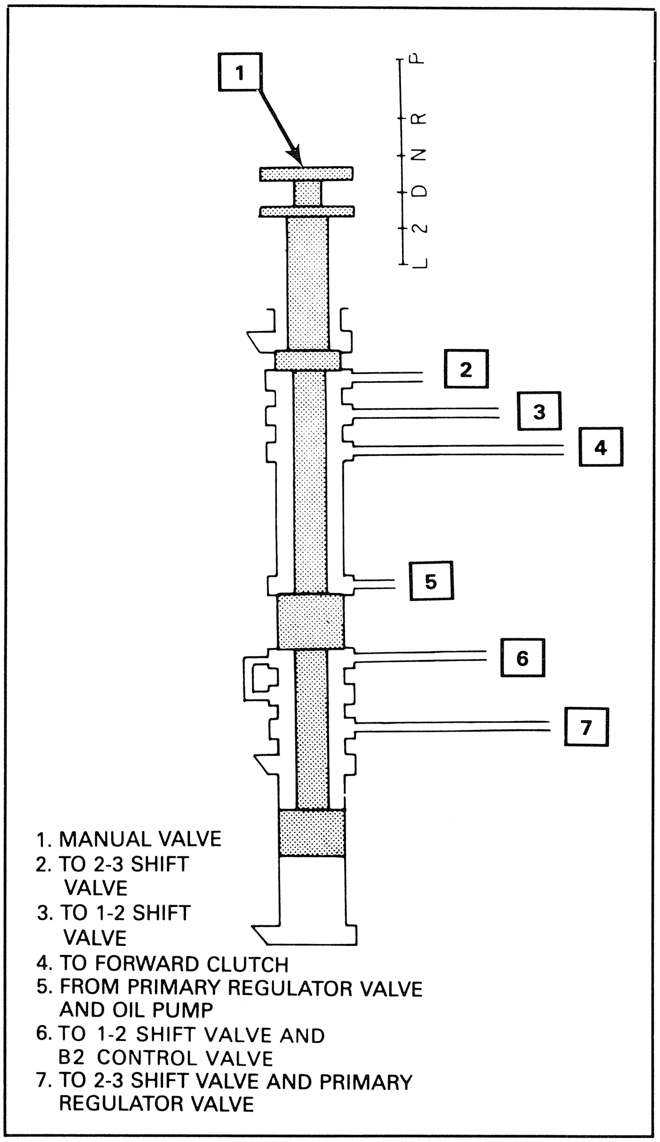


1. OIL PUMP BODY
2. OIL PUMP DRIVE GEAR
3. OIL PUMP DRIVEN GEAR

Figure 7A1-16 Oil Pump

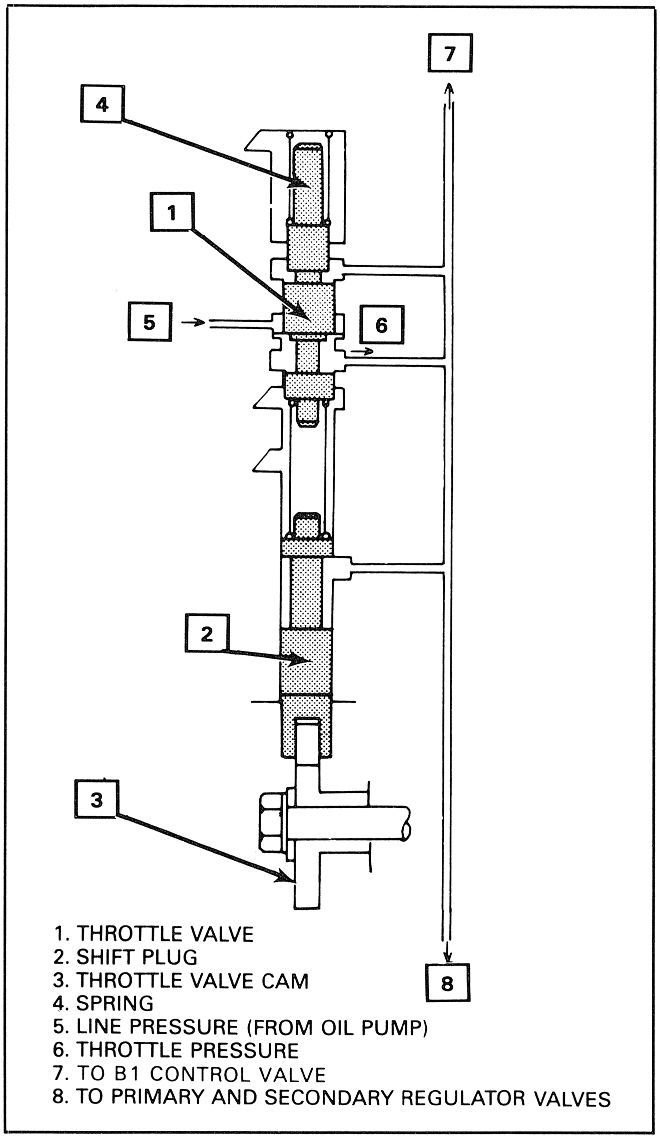
PRIMARY REGULATOR VALVE

This valve regulates the oil pressure produced by the oil pump (line pressure) to correspond to each condition of use. It is operated by the throttle pressure, line pressure when in reverse and the springs.



1. MANUAL VALVE
2. TO 2-3 SHIFT VALVE
3. TO 1-2 SHIFT VALVE
4. TO FORWARD CLUTCH
5. FROM PRIMARY REGULATOR VALVE AND OIL PUMP
6. TO 1-2 SHIFT VALVE AND B2 CONTROL VALVE
7. TO 2-3 SHIFT VALVE AND PRIMARY REGULATOR VALVE

Figure 7A1-17 Manual Valve



1. THROTTLE VALVE
2. SHIFT PLUG
3. THROTTLE VALVE CAM
4. SPRING
5. LINE PRESSURE (FROM OIL PUMP)
6. THROTTLE PRESSURE
7. TO B1 CONTROL VALVE
8. TO PRIMARY AND SECONDARY REGULATOR VALVES

Figure 7A1-18 Throttle Valve

SECONDARY REGULATOR VALVE

This valve regulates the oil pressure to the torque converter and lubricating oil pressure to each part of the transmission by means of the throttle pressure and spring.

B2 CONTROL VALVE

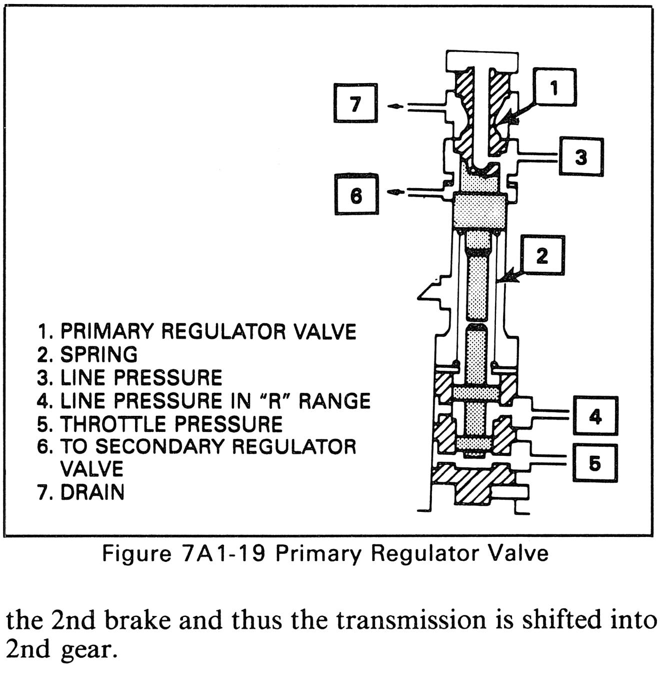
When in "L" range, this valve controls the line pressure acting on the 1st-reverse brake to reduce a shock.

COOLER BY-PASS VALVE

This valve is provided to keep the oil pressure in the torque converter constant.

1-2 SHIFT VALVE

This valve carries out the gear shift between 1st and 2nd gears. When the 2nd brake solenoid operates, the line pressure is applied to the shift valve and the valve moves to allow the line pressure to be applied to the 2nd brake and thus the transmission is shifted into 2nd gear.



1. PRIMARY REGULATOR VALVE
2. SPRING
3. LINE PRESSURE
4. LINE PRESSURE IN "R" RANGE
5. THROTTLE PRESSURE
6. TO SECONDARY REGULATOR VALVE
7. DRAIN

Figure 7A1-19 Primary Regulator Valve

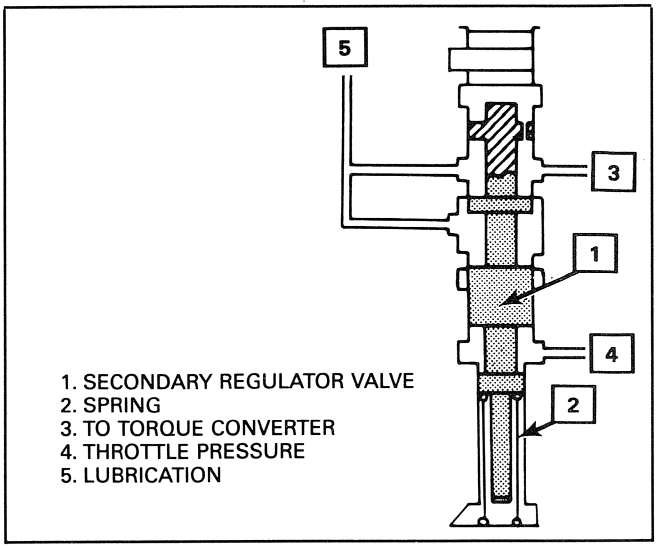

1. SECONDARY REGULATOR VALVE
2. SPRING
3. TO TORQUE CONVERTER
4. THROTTLE PRESSURE
5. LUBRICATION

Figure 7A1-20 Secondary Regulator Valve

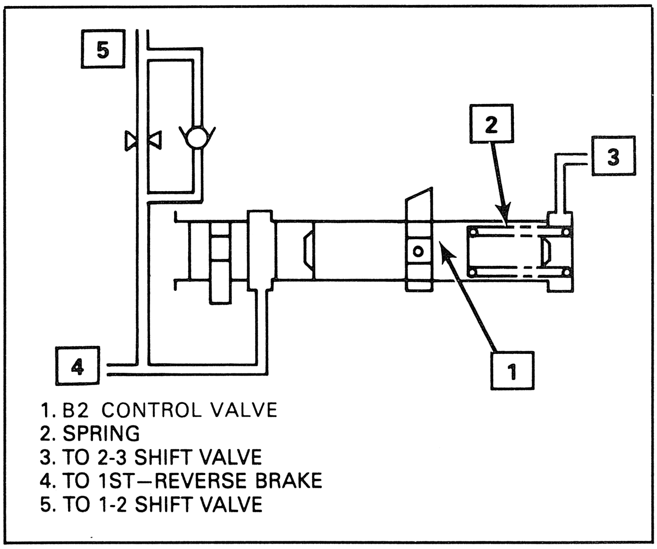

1. B2 CONTROL VALVE
2. SPRING
3. TO 2-3 SHIFT VALVE
4. TO 1ST–REVERSE BRAKE
5. TO 1-2 SHIFT VALVE

Figure 7A1-21 B2 Control Valve

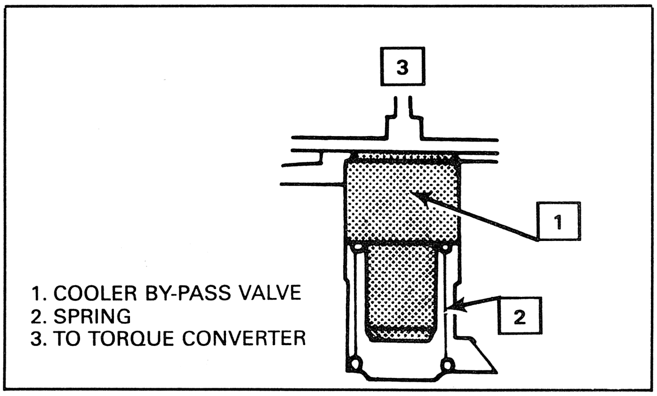

1. COOLER BY-PASS VALVE
2. SPRING
3. TO TORQUE CONVERTER

Figure 7A1-22 Cooler By-Pass Valve

When the oil pressure to the 2nd brake solenoid is relieved, the shift valve returns by means of the spring force and the transmission is shifted to the 1st gear.

In "L" or "R" range, the oil pressure is applied to the 1st-reverse brake when the 2nd brake solenoid operates.

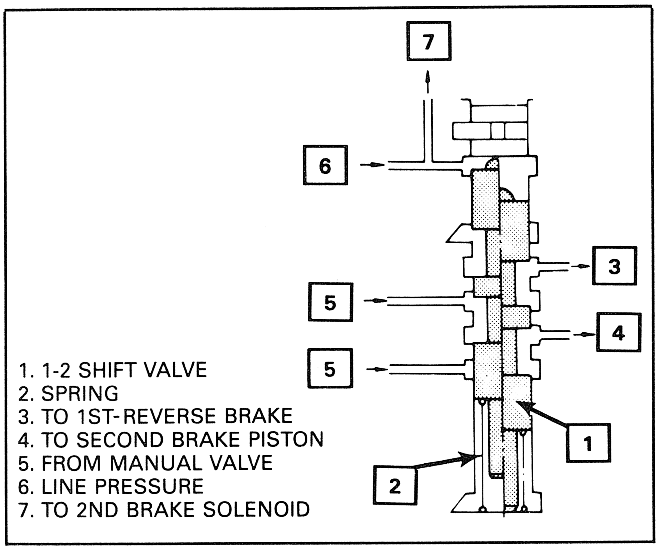

1. 1-2 SHIFT VALVE
2. SPRING
3. TO 1ST-REVERSE BRAKE
4. TO SECOND BRAKE PISTON
5. FROM MANUAL VALVE
6. LINE PRESSURE
7. TO 2ND BRAKE SOLENOID

Figure 7A1-23 1-2 Shift Valve

2-3 SHIFT VALVE

This valve carries out the gear shift between 2nd and 3rd gears. When the direct clutch solenoid operates, the line pressure is applied to the shift valve and the valve moves to allow the line pressure to be applied to the direct clutch and thus the transmission is shifted from the 2nd gear to the 3rd gear.

When the oil pressure to the solenoid is relieved, the shift valve returns by means of the spring force and the transmission is shifted to the 2nd gear.

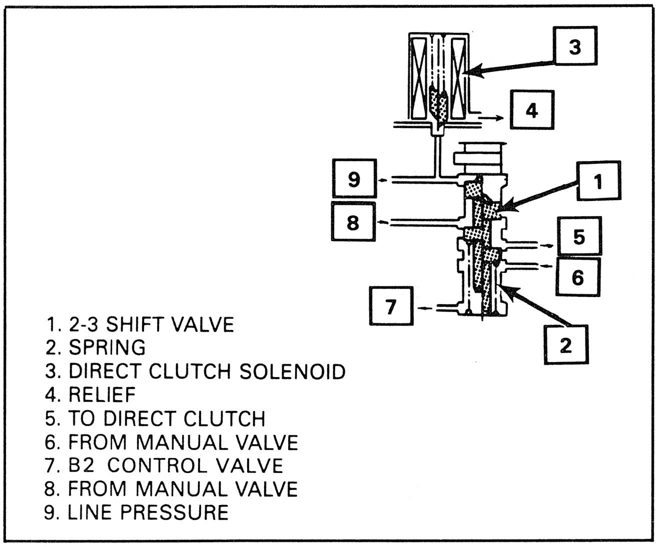

1. 2-3 SHIFT VALVE
2. SPRING
3. DIRECT CLUTCH SOLENOID
4. RELIEF
5. TO DIRECT CLUTCH
6. FROM MANUAL VALVE
7. B2 CONTROL VALVE
8. FROM MANUAL VALVE
9. LINE PRESSURE

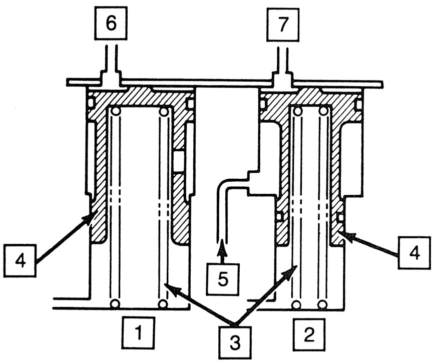
Figure 7A1-24 2-3 Shift Valve

ACCUMULATOR

This serves to reduce a shock in each gear shift. There are two accumulators, one for the forward clutch and the other for the 2nd brake.

DIRECT CLUTCH AND 2ND BRAKE SOLENOIDS

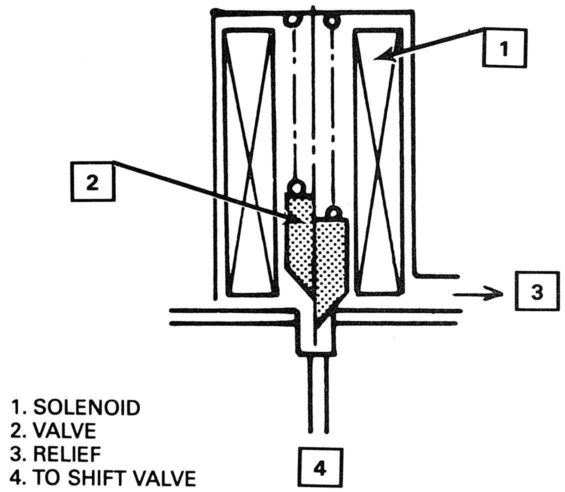
These solenoids turn ON and OFF by the electric signals from the controller (computer). They serve to control the gear shift by operating the 1 - 2 and 2 - 3 shift valves. Direct clutch solenoid operates the 2 - 3 shift valve, and 2nd brake solenoid operates the 1 - 2



1. FORWARD CLUTCH ACCUMULATOR
2. 2ND BRAKE ACCUMULATOR
3. SPRING
4. PISTON
5. LINE PRESSURE
6. FROM FORWARD CLUTCH
7. FROM 2ND BRAKE PISTON

Figure 7A1-25 Accumulator

shift valve. When the solenoid valve is ON, the valve moves up to relieve the line pressure and when OFF, the valve moves down and therefore the line pressure is applied to the shift valve.



1. SOLENOID
2. VALVE
3. RELIEF
4. TO SHIFT VALVE

Figure 7A1-26 Direct Clutch and 2nd Brake Solenoids

OIL COOLING SYSTEM

The oil cooler of dual pipe type is built in the lower tank of the engine cooling radiator and cools the automatic transaxle fluid.

GEAR SHIFT CONTROL SYSTEM

Controller

The controller controls the 2nd brake solenoid and the direct clutch solenoid by sending electric signals to them so as to attain automatic gear shift between the 1st and 2nd gears, and the 2nd and 3rd gears.

The controller sensed parameters are the throttle position sensor, neutral safety switch, and speed sensor. The switch and sensors sense the carburetor throttle valve opening, selector lever's position and vehicle speed, and send these signals to the controller. Then, the controller opens and closes the valves of the above solenoids according to these signals. The controller is located at the left corner inside the instrument main panel.

THROTTLE POSITION SENSOR (TPS)

The throttle position sensor consisting of an idle switch and a potentiometer is connected to the throttle valve shaft.

Idle signal (ON signal when idling) and throttle valve opening signal (output voltage) are transmitted from TPS to ECM as voltage signal. The signal is converted to ON/OFF informations in ECM, and they are sent to controller through three lines.

NEUTRAL SAFETY SWITCH

Being linked with the selector lever, this switch changes selector lever positions into electric signals and sends them to the controller. The contact points of this switch for "P" and "N" ranges are also connected with the starter motor circuit. When the selector lever is shifted to the "P" or "N" position, the contact points for "P" or "N" range are connected and cause the starter motor to operate by turning the starter switch "ON". When the selector lever is in any other position than "P" and "N", the switch remains "OFF" and therefore the starter motor cannot be operated, that is, the engine cannot be started. Also, as its contact point for "R" range is connected with the backup light circuit and the selector lever is shifted to "R" range, the contact point contacts to light the backup lights.

DIRECT CLUTCH AND 2ND BRAKE SOLENOIDS

These solenoids are mounted on the valve body. They are turned ON and OFF by the signals from the controller and actuate each shift valve (1 - 2 and 2 - 3 valves) so as to control transmission gear shift.

The 2nd brake solenoid operates 1 - 2 shift valve, and direct clutch solenoid does 2 - 3 shift valve.

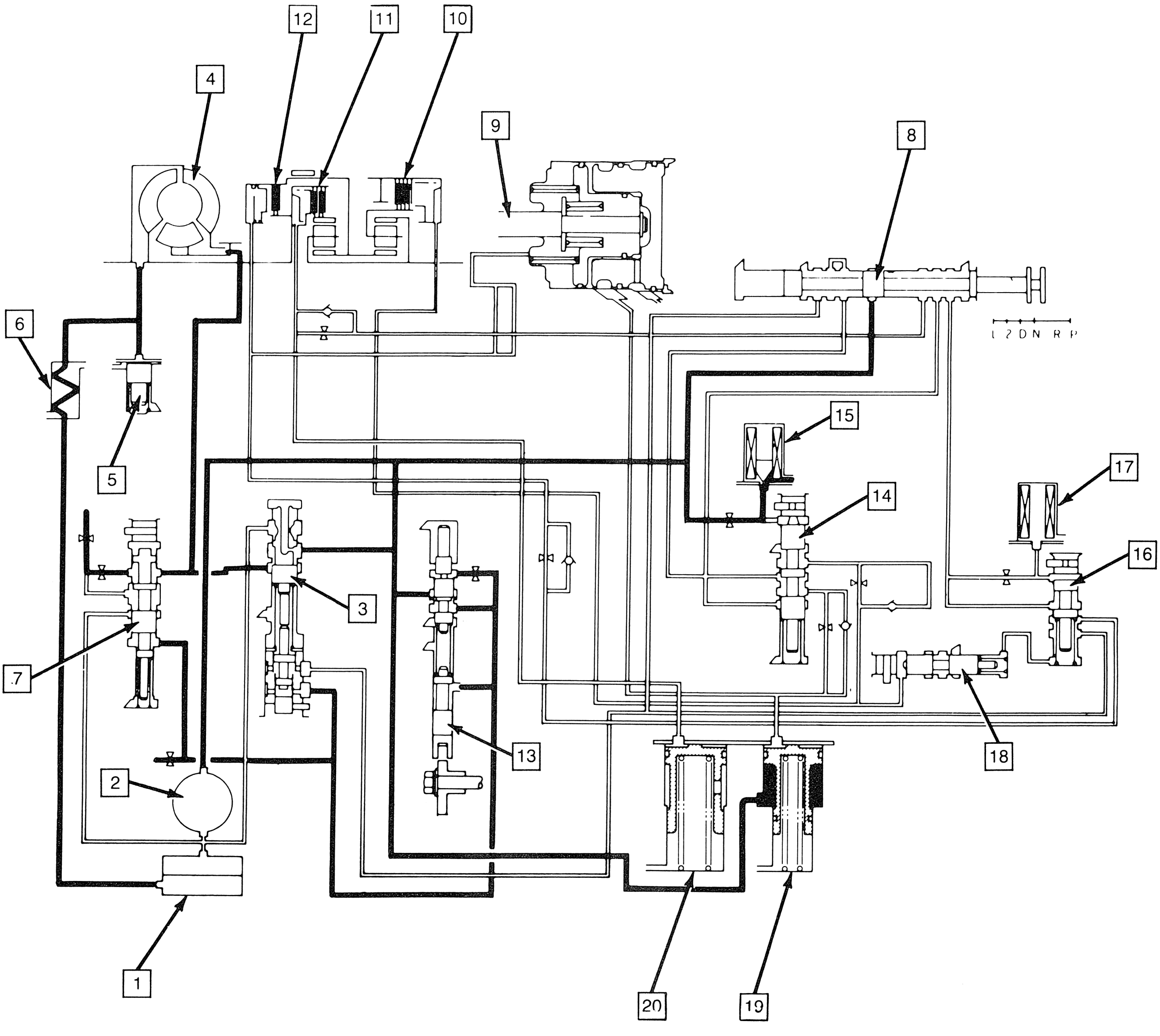
SPEED SENSOR

The speed sensor consists of a magnetic core with magnet and coil. It is mounted on transmission case with 0.6 mm (0.024 in) air gap between the core end and countershaft gear tooth. While the countershaft rotates, magnetic flux is cut by gear tooth. Thus a pulse is generated in the sensor coil according to the speed. And then, the pulse is transmitted to control module as speed signal.

OIL CIRCUIT IN "N" RANGE

When the engine is started and the oil pump starts to operate, oil in the oil pan passes thru the oil pump, is regulated by the primary regulator valve and sent to the torque converter. Also, the oil which is further regulated by the secondary regulator valve lubricates each part of the transmission.

In this range, the oil pressure is not applied to any clutch or brake as the line pressure from the regulator valve is stopped by means of the manual valve.



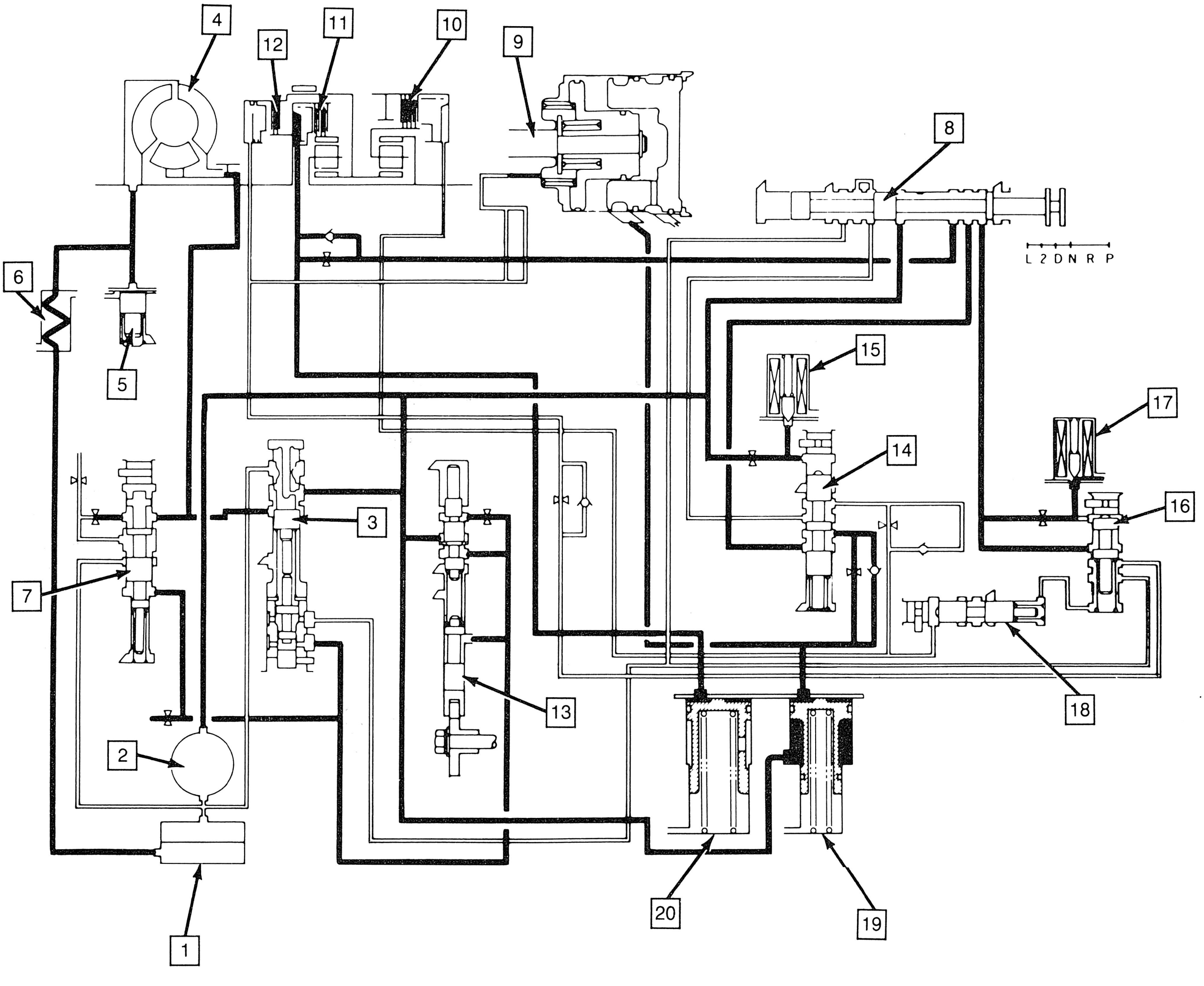
1. OIL PAN
2. OIL PUMP
3. PRIMARY REGULATOR VALVE
4. TORQUE CONVERTER
5. COOLER BY-PASS VALVE
6. OIL COOLER
7. SECONDARY REGULATOR VALVE
8. MANUAL VALVE
9. 2ND BRAKE PISTON
10. 1ST-REVERSE BRAKE
11. FORWARD CLUTCH
12. DIRECT CLUTCH
13. THROTTLE VALVE
14. 1-2 SHIFT VALVE
15. 2ND BRAKE SOLENOID
16. 2-3 SHIFT VALVE
17. DIRECT CLUTCH SOLENOID
18. B2 CONTROL VALVE
19. 2ND BRAKE ACCUMULATOR
20. FORWARD CLUTCH ACCUMULATOR

Figure 7A1-27 Oil Circuit in "N" Range

OIL CIRCUIT IN "D" OR "2" RANGE (1ST GEAR)

The line pressure which has passed through the manual valve is applied directly to the forward clutch. As this causes the clutch to be engaged, the 1st gear is shifted. The line pressure is also applied to the accumulator to reduce shocks at the time of clutch engagement.

As the direct clutch and the 2nd brake solenoids receive the electric signal from the controller, that is, they are turned ON, they relieve the line pressure. Therefore, neither the 1-2 nor 2-3 shift valve operates due to no oil pressure.

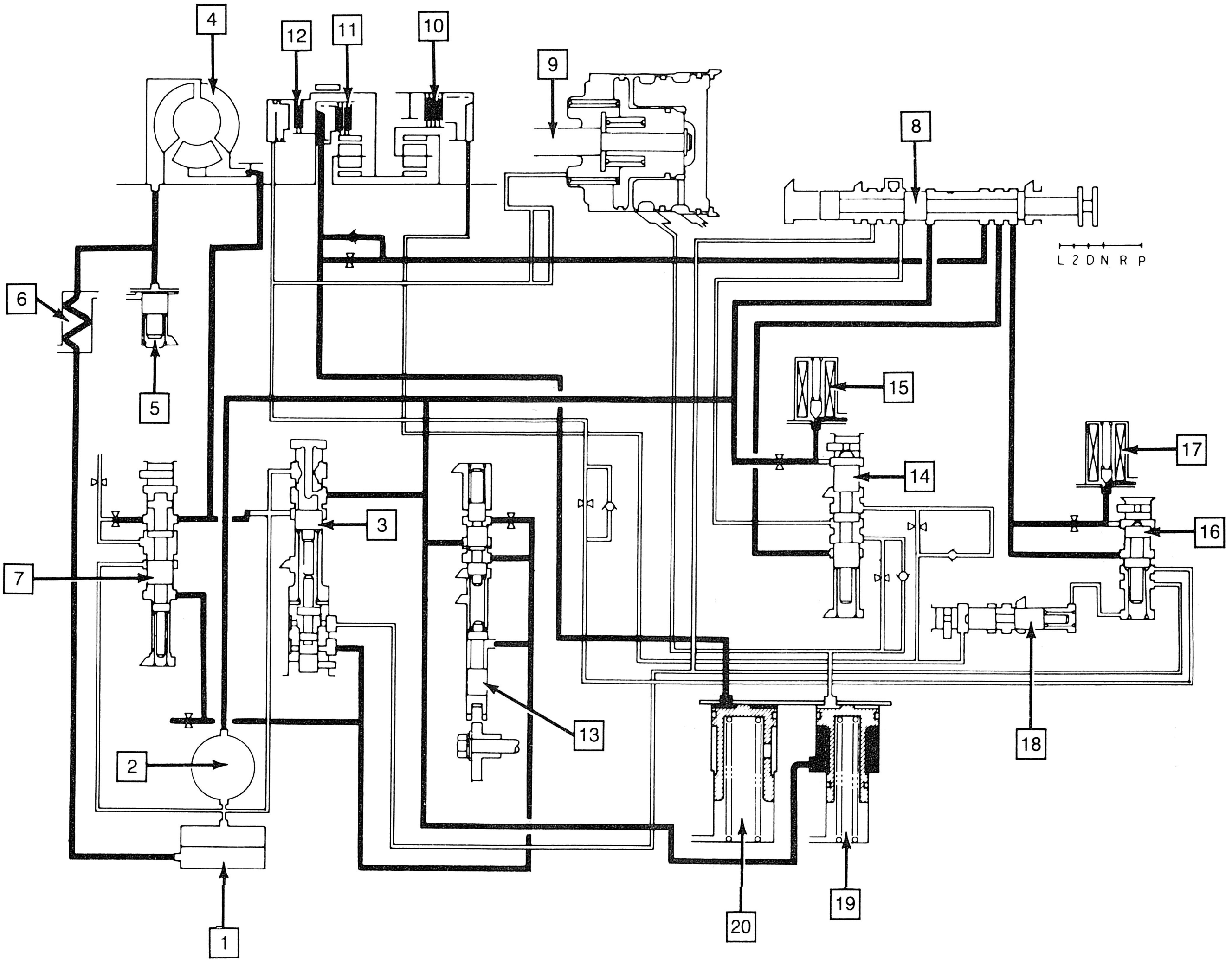


1. OIL PAN
2. OIL PUMP
3. PRIMARY REGULATOR VALVE
4. TORQUE CONVERTER
5. COOLER BY-PASS VALVE
6. OIL COOLER
7. SECONDARY REGULATOR VALVE
8. MANUAL VALVE
9. 2ND BRAKE PISTON
10. 1ST-REVERSE BRAKE
11. FORWARD CLUTCH
12. DIRECT CLUTCH
13. THROTTLE VALVE
14. 1-2 SHIFT VALVE
15. 2ND BRAKE SOLENOID
16. 2-3 SHIFT VALVE
17. DIRECT CLUTCH SOLENOID
18. B2 CONTROL VALVE
19. 2ND BRAKE ACCUMULATOR
20. FORWARD CLUTCH ACCUMULATOR

Figure 7A1-28 Oil Circuit in "D" or "2" Range (1st Gear)

OIL CIRCUIT IN "D" OR "2" RANGE (2ND GEAR)

As the car speed is accelerated at the 1st gear and reaches the 2nd gear shift point, the 2nd brake solenoid turns OFF and closes the relief circuit. This causes line pressure ① to act on the 1-2 shift valve. Then the valve moves to allow the line pressure ③ to be applied to the 2nd brake and the 2nd gear is attained. At this time, the line pressure ③ is also applied to the accumulator to reduce a shock occurring when the 2nd brake works.



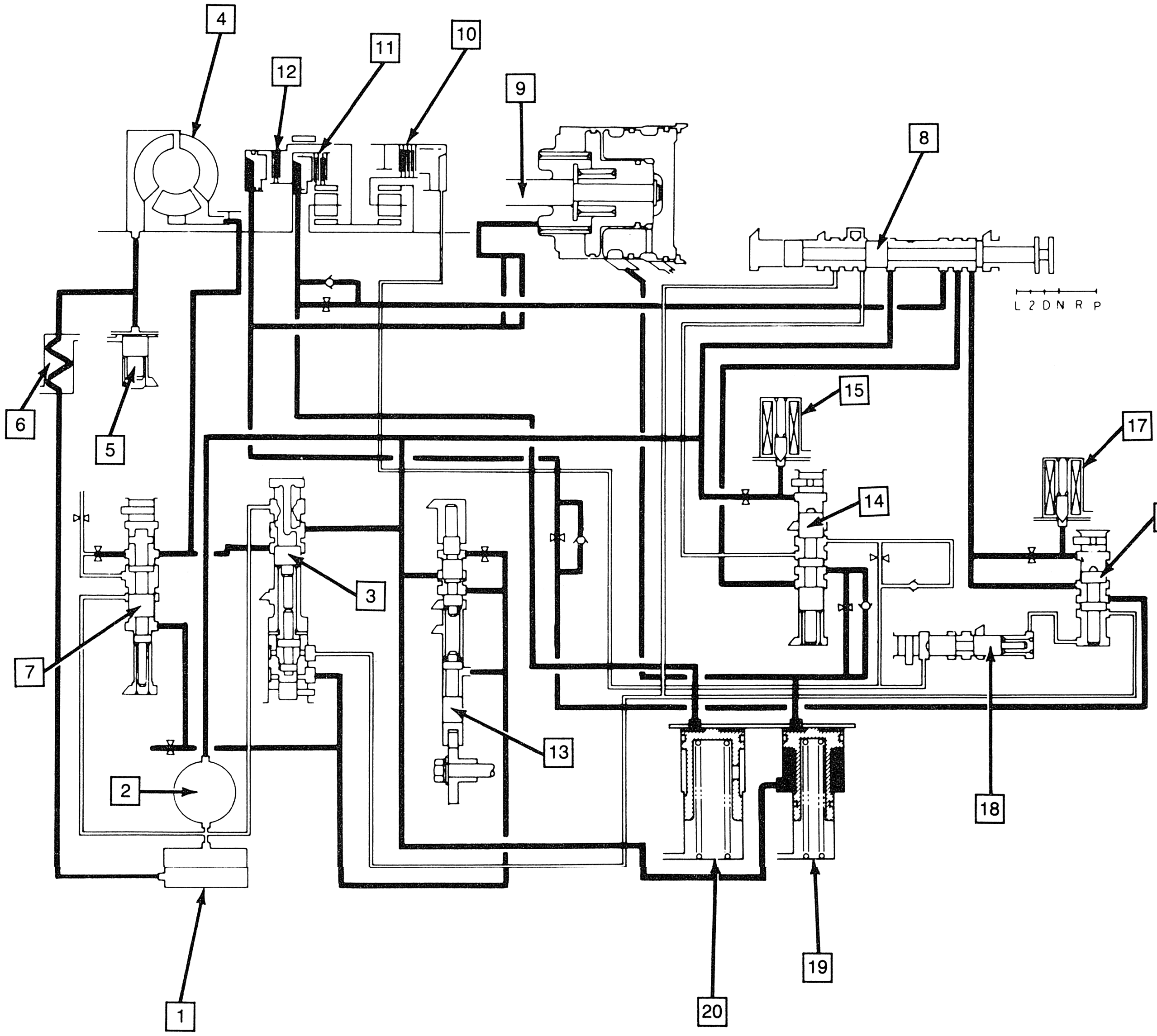
1. OIL PAN
2. OIL PUMP
3. PRIMARY REGULATOR VALVE
4. TORQUE CONVERTER
5. COOLER BY-PASS VALVE
6. OIL COOLER
7. SECONDARY REGULATOR VALVE
8. MANUAL VALVE
9. 2ND BRAKE PISTON
10. 1ST-REVERSE BRAKE
11. FORWARD CLUTCH
12. DIRECT CLUTCH
13. THROTTLE VALVE
14. 1-2 SHIFT VALVE
15. 2ND BRAKE SOLENOID
16. 2-3 SHIFT VALVE
17. DIRECT CLUTCH SOLENOID
18. B2 CONTROL VALVE
19. 2ND BRAKE ACCUMULATOR
20. FORWARD CLUTCH ACCUMULATOR

Figure 7A1-29 Oil Circuit in "D" or "2" Range (2nd Gear)

OIL CIRCUIT IN "D" RANGE (3RD GEAR)

As the car speed is further accelerated in the 2nd gear and reaches the 3rd gear shift point, the direct clutch solenoid turns OFF and closes the relief circuit. This causes the line pressure ④ to be applied to the 2-3 shift valve. Then the oil pressure is applied to the direct clutch to make it engaged. At the same time, the the oil pressure acts, as a back pressure, on the 2nd brake piston. Thus the 2nd brake piston is pushed back, the 2nd brake is released and the 3rd gear is attained.

In this state, as the 2nd brake solenoid is OFF, the 1-2 shift valve is at work and opens the oil passage to the 2nd brake but the 2nd brake is balanced with the above mentioned back pressure and the return spring force pushes back the piston to prevent the 2nd brake from operating.

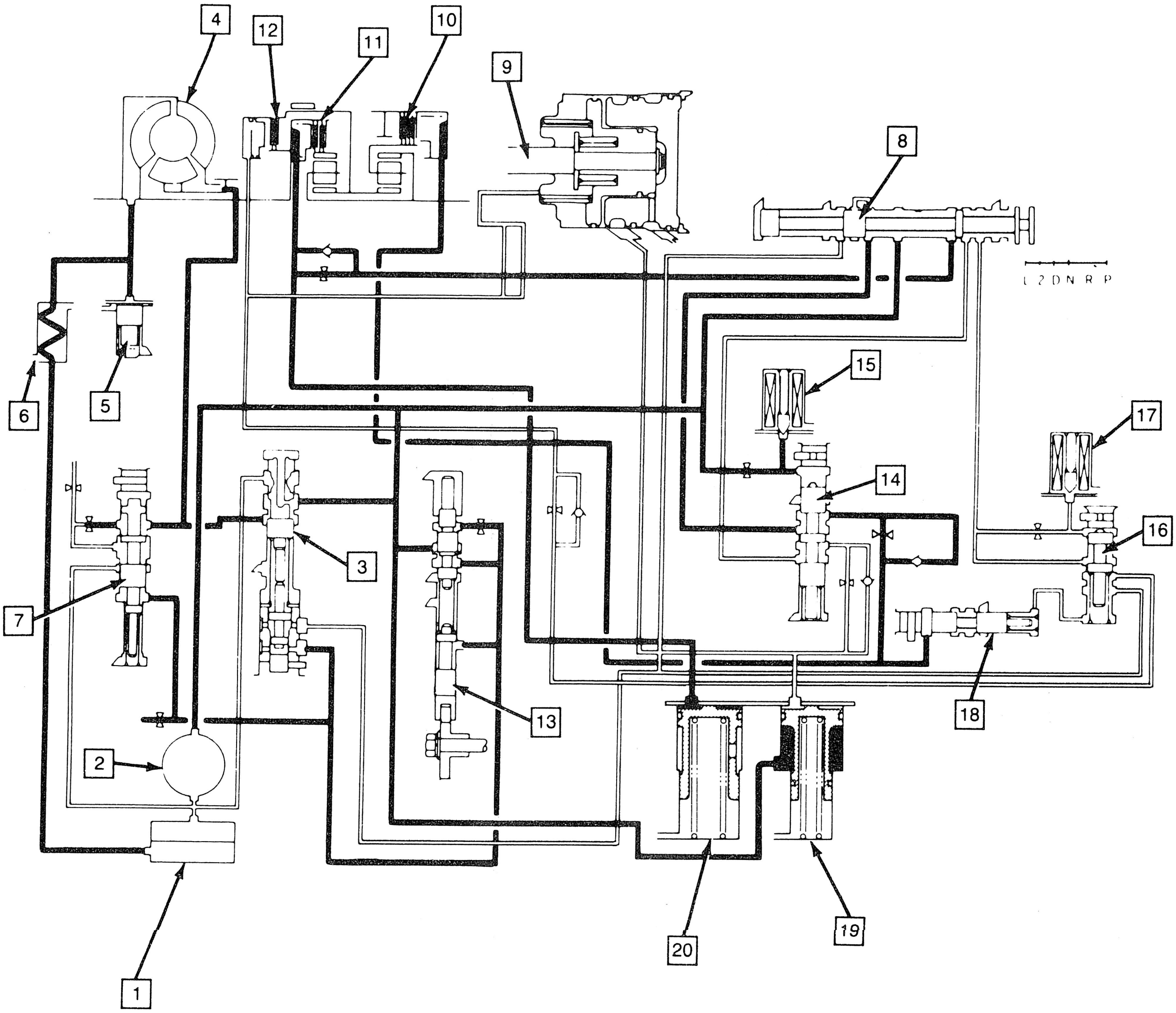


1. OIL PAN
2. OIL PUMP
3. PRIMARY REGULATOR VALVE
4. TORQUE CONVERTER
5. COOLER BY-PASS VALVE
6. OIL COOLER
7. SECONDARY REGULATOR VALVE
8. MANUAL VALVE
9. 2ND BRAKE PISTON
10. 1ST-REVERSE BRAKE
11. FORWARD CLUTCH
12. DIRECT CLUTCH
13. THROTTLE VALVE
14. 1-2 SHIFT VALVE
15. 2ND BRAKE SOLENOID
16. 2-3 SHIFT VALVE
17. DIRECT CLUTCH SOLENOID
18. B2 CONTROL VALVE
19. 2ND BRAKE ACCUMULATOR
20. FORWARD CLUTCH ACCUMULATOR

Figure 7A1-30 Oil Circuit in "D" Range (3rd Gear)

OIL CIRCUIT IN "L" RANGE

The line pressure ①, after passing thru the manual valve, comes out as the line pressures ②and ⑤. The line pressure ② is applied to the forward clutch. In this state, as the 2nd brake solenoid is OFF because it is not electrically charged from the controller, the line pressure ① is applied to the 1-2 shift valve. Then the line pressure is applied to the 1st-reverse brake. Consequently the 1st gear is attained.



1. OIL PAN
2. OIL PUMP
3. PRIMARY REGULATOR VALVE
4. TORQUE CONVERTER
5. COOLER BY-PASS VALVE
6. OIL COOLER
7. SECONDARY REGULATOR VALVE
8. MANUAL VALVE
9. 2ND BRAKE PISTON
10. 1ST-REVERSE BRAKE
11. FORWARD CLUTCH
12. DIRECT CLUTCH
13. THROTTLE VALVE
14. 1-2 SHIFT VALVE
15. 2ND BRAKE SOLENOID
16. 2-3 SHIFT VALVE
17. DIRECT CLUTCH SOLENOID
18. B2 CONTROL VALVE
19. 2ND BRAKE ACCUMULATOR
20. FORWARD CLUTCH

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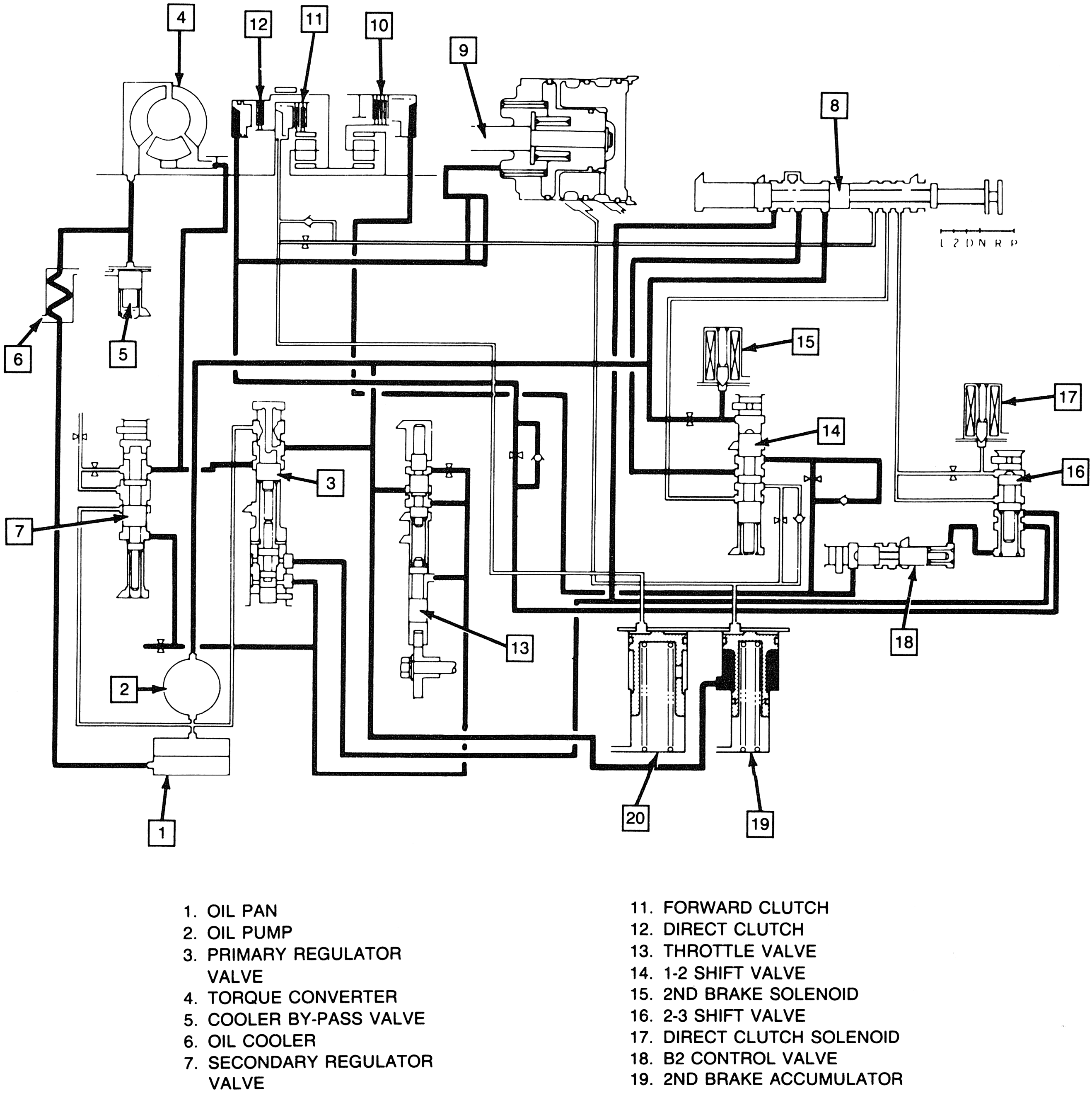
Figure 7A1-31 Oil Circuit in "L" Range

OIL CIRCUIT IN "R" RANGE

The line pressure ①, after passing thru the manual valve, comes out as the line pressures ⑤ and ⑥. In this state, as the 2nd brake solenoid is OFF, the line pressure ① is applied to the 1-2 shift valve and the line pressure ⑤ is applied to the 1st-reverse brake after passing through the B_2 Control valve. On the other hand, the line pressure ⑥ is applied to the direct clutch via the 2-3 shift valve, thus resulting in the reverse gear. Also, a part of the line pressure ⑥ acts on the primary regulator valve to regulate the line pressure ①.



1. OIL PAN
2. OIL PUMP
3. PRIMARY REGULATOR VALVE
4. TORQUE CONVERTER
5. COOLER BY-PASS VALVE
6. OIL COOLER
7. SECONDARY REGULATOR VALVE
8. MANUAL VALVE
9. 2ND BRAKE PISTON
10. 1ST-REVERSE BRAKE
11. FORWARD CLUTCH
12. DIRECT CLUTCH
13. THROTTLE VALVE
14. 1-2 SHIFT VALVE
15. 2ND BRAKE SOLENOID
16. 2-3 SHIFT VALVE
17. DIRECT CLUTCH SOLENOID
18. B2 CONTROL VALVE
19. 2ND BRAKE ACCUMULATOR
20. FORWARD CLUTCH ACCUMULATOR

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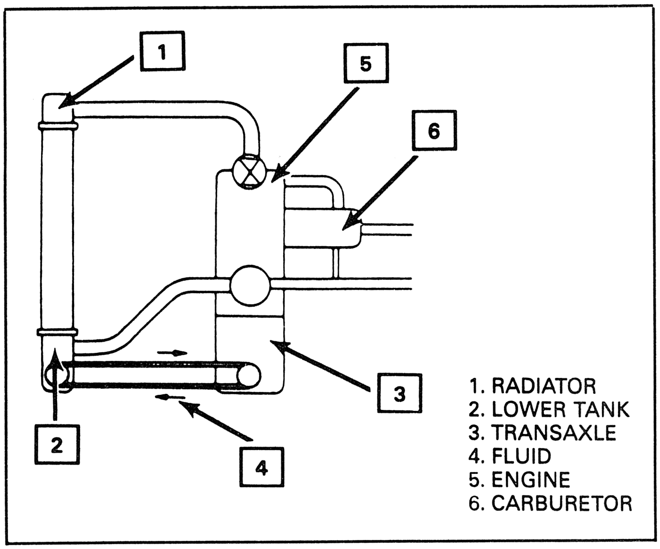
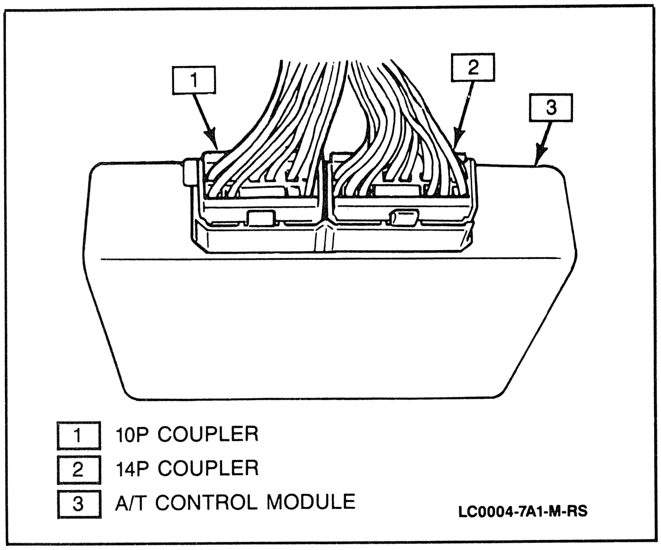
Figure 7A1-32 Oil Circuit in "R" Range



1. RADIATOR
2. LOWER TANK
3. TRANSAXLE
4. FLUID
5. ENGINE
6. CARBURETOR

Figure 7A1-33 Oil Cooling System


1
2
3
LC0004-7A1-M-RS

1	10P COUPLER
2	14P COUPLER
3	A/T CONTROL MODULE

Figure 7A1-34 Controller

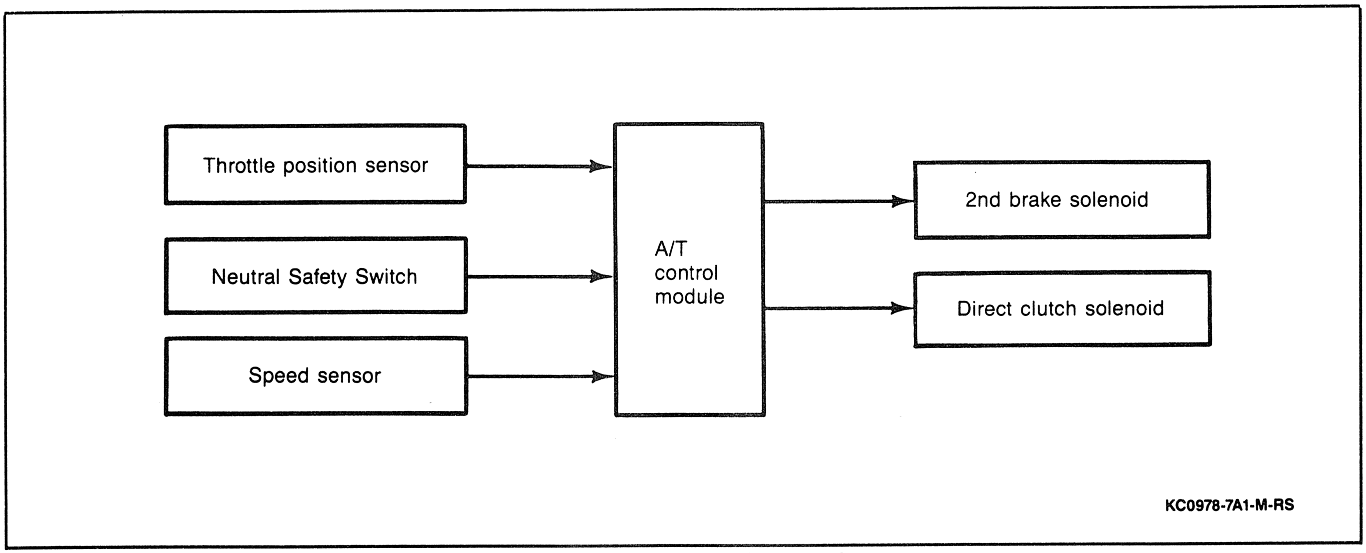
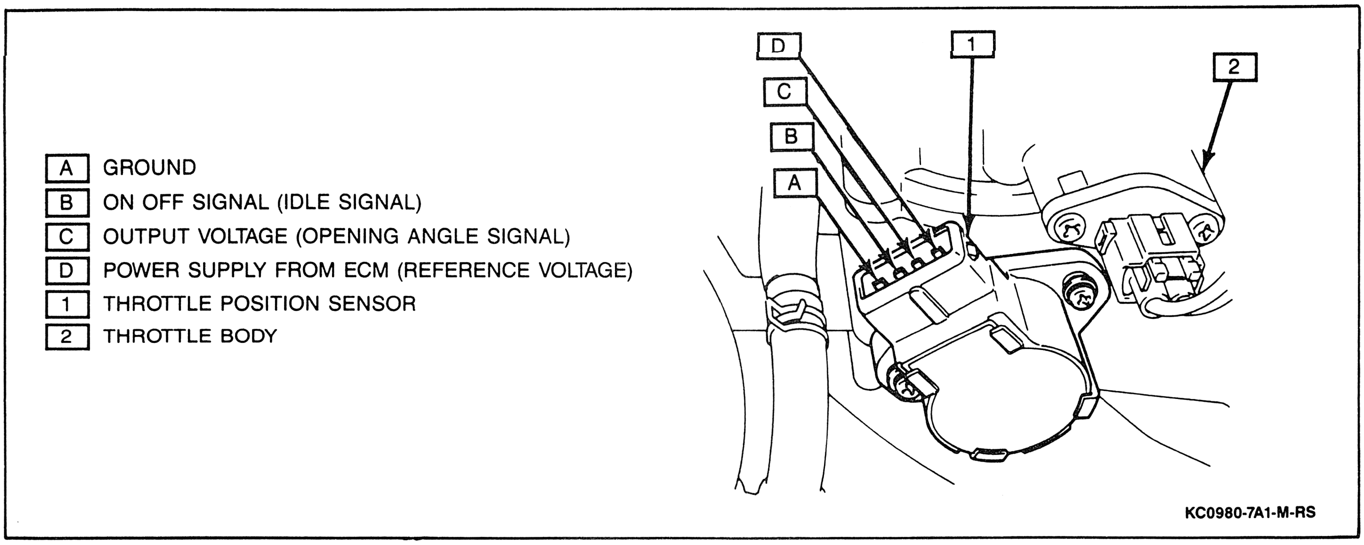
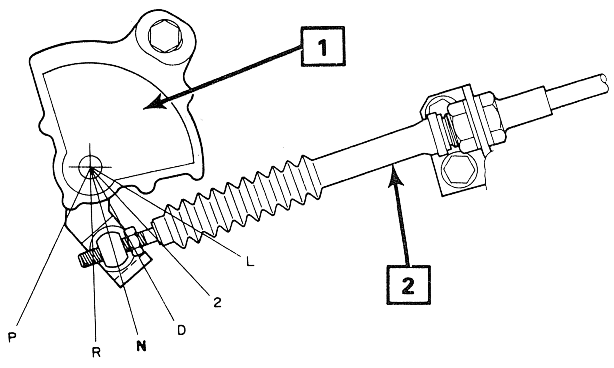

Throttle position sensor
Neutral Safety Switch
Speed sensor
A/T control module
2nd brake solenoid
Direct clutch solenoid
KC0978-7A1-M-RS

Figure 7A1-35 Gear Shift Control System


D
C
B
A
1
2
KC0980-7A1-M-RS

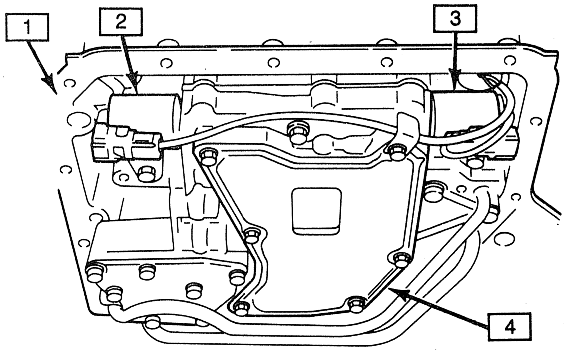
A	GROUND
B	ON OFF SIGNAL (IDLE SIGNAL)
C	OUTPUT VOLTAGE (OPENING ANGLE SIGNAL)
D	POWER SUPPLY FROM ECM (REFERENCE VOLTAGE)
1	THROTTLE POSITION SENSOR
2	THROTTLE BODY

Figure 7A1-36 Throttle Position Sensor



1. NEUTRAL SAFETY SWITCH
2. SELECT CABLE

Figure 7A1-37 Shift Lever Switch



1 TRANSMISSION
2 2ND BRAKE SOLENOID
3 DIRECT CLUTCH SOLENOID
4 OIL STRAINER

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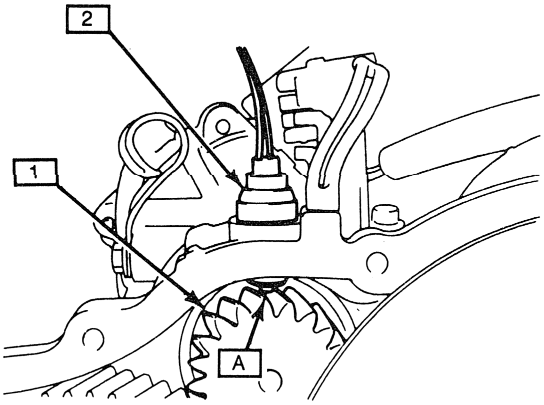
Figure 7A1-38 Direct Clutch and 2nd Brake Solenoid

Range	D			2		L		R	P
Gear	1st	2nd	3rd	1st	2nd	1st	(2nd)	–	–
Direct clutch solenoid	○	○	X	X	○	X	X	X	X
2nd brake solenoid	○	X	X	○	X	X	○	X	X

○ Operated (Solenoid Valve is Open) X Unoperated (Solenoid Valve is Close)

Figure 7A1-39 Operation of Direct Clutch and 2nd Brake Solenoids



A MAGNETIC CORE END
1 COUNTERSHAFT GEAR
2 SPEED SENSOR

KC0984-7A1-M-RS

Figure 7A1-40 Speed Sensor

AUTOMATIC TRANSAXLE UNIT

Systematic trouble shooting

Before performing systematic trouble-shooting described in this section, make sure to check each of the following:

1. Engine coolant temperature is at normal operating temperature.
2. Engine idle speed is 800 – 900 rpm.
3. Transaxle fluid level is between "FULL HOT" and "LOW HOT" on oil level gauge at normal operating temperature of transaxle fluid.
4. Accelerator cable, oil pressure control cable and select cable are adjusted properly.
5. Electric circuit of gear shift control system is free from break, coupler disconnection and poor contact.

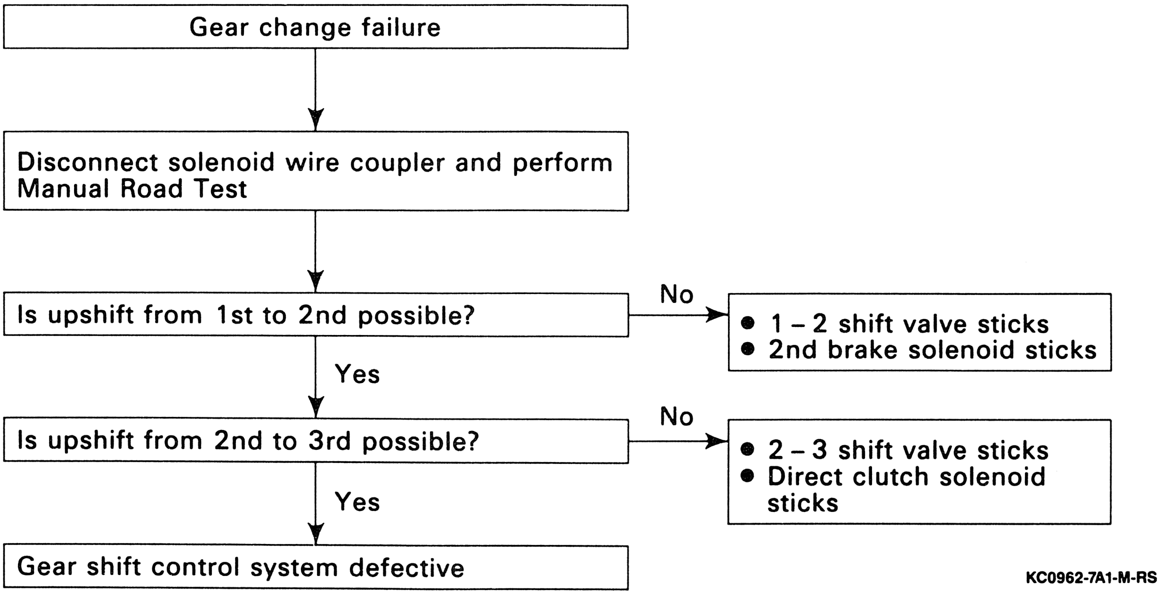

Gear change failure
Disconnect solenoid wire coupler and perform Manual Road Test
Is upshift from 1st to 2nd possible?
No
● 1 – 2 shift valve sticks
● 2nd brake solenoid sticks
Yes
Is upshift from 2nd to 3rd possible?
No
● 2 – 3 shift valve sticks
● Direct clutch solenoid sticks
Yes
Gear shift control system defective
KC0962-7A1-M-RS

Figure 7A1-41 Diagnosis Chart (A)

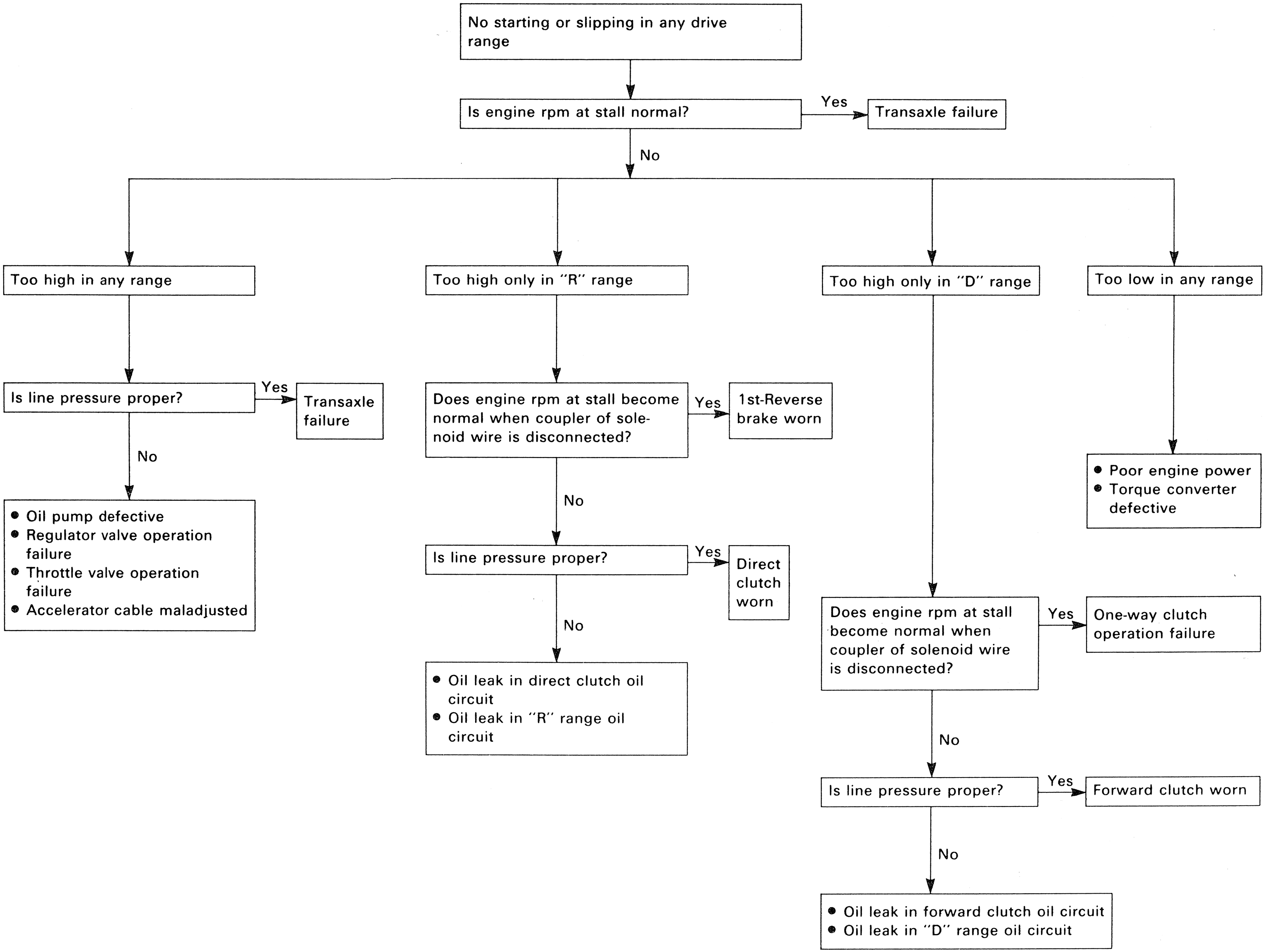

No starting or slipping in any drive range
Is engine rpm at stall normal?
Yes
Transaxle failure
No
Too high in any range
Too high only in "R" range
Too high only in "D" range
Too low in any range
Is line pressure proper?
Yes
Transaxle failure
No
• Oil pump defective
• Regulator valve operation failure
• Throttle valve operation failure
• Accelerator cable maladjusted
Does engine rpm at stall become normal when coupler of solenoid wire is disconnected?
Yes
1st-Reverse brake worn
No
Is line pressure proper?
Yes
Direct clutch worn
No
• Oil leak in direct clutch oil circuit
• Oil leak in "R" range oil circuit
Does engine rpm at stall become normal when coupler of solenoid wire is disconnected?
Yes
One-way clutch operation failure
No
Is line pressure proper?
Yes
Forward clutch worn
No
• Oil leak in forward clutch oil circuit
• Oil leak in "D" range oil circuit
• Poor engine power
• Torque converter defective

Figure 7A1-42 Diagnosis Chart (B)

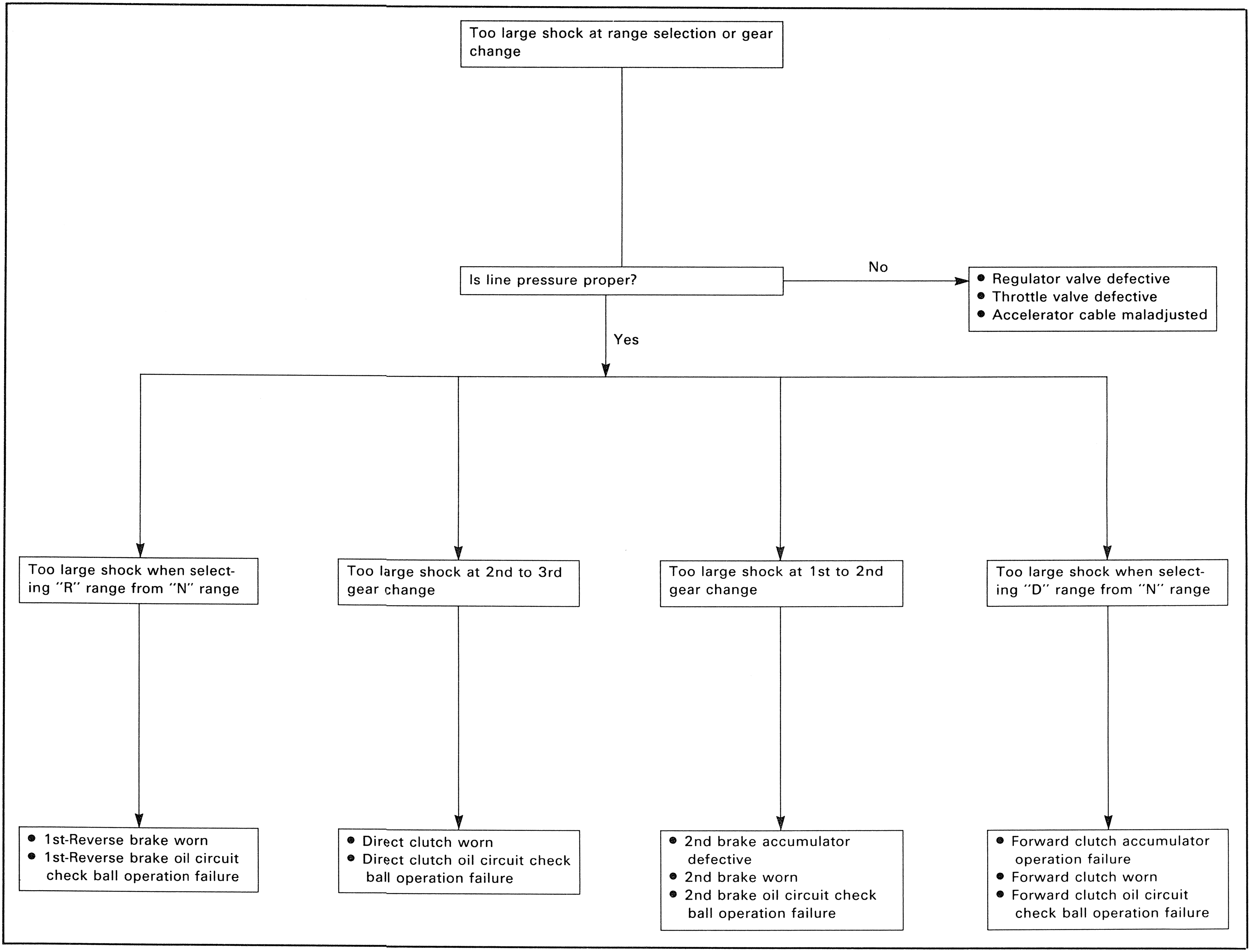

Too large shock at range selection or gear change
Is line pressure proper?
No
• Regulator valve defective
• Throttle valve defective
• Accelerator cable maladjusted
Yes
Too large shock when selecting "R" range from "N" range
Too large shock at 2nd to 3rd gear change
Too large shock at 1st to 2nd gear change
Too large shock when selecting "D" range from "N" range
• 1st-Reverse brake worn
• 1st-Reverse brake oil circuit check ball operation failure
• Direct clutch worn
• Direct clutch oil circuit check ball operation failure
• 2nd brake accumulator defective
• 2nd brake worn
• 2nd brake oil circuit check ball operation failure
• Forward clutch accumulator operation failure
• Forward clutch worn
• Forward clutch oil circuit check ball operation failure

Figure 7A1-43 Diagnosis Chart (C)

DIAGNOSIS

LINE PRESSURE TEST

This test is used to check the oil pressure system for operation by measuring the oil pressure line. Make sure to perform the test only when transaxle fluid is at normal operating temperature. Also, check for the following before the test.

- Transaxle fluid level is between "FULL HOT" and "LOW HOT" marks on oil level gauge (at normal operating temperature of fluid).
- Transaxle is free of oil leakage.

Test procedure is as follows.

1. With the engine off, remove plug as shown in Figure 7A1-44 and connect oil pressure gage to the threaded hole.
2. Install tachometer.
3. Apply parking brake and block vehicle wheels.
4. With selector lever shifted to "P" position, start the engine.
5. Depress brake pedal fully.
6. Shift selector lever to "D" range and check oil pressure with engine running at 800-900 rpm and at 2,200-2,700 rpm respectively.
7. Repeat the same check as in step 6 with selector lever shifted to "R" range.

NOTICE: Don't run engine at stall more than 5 seconds continuously, for oil temperature may rise excessively high.

8. If the line pressure is within the specifications found in Figure 7A1-45, the oil pressure system is in good condition.
9. Possible causes for out-of-specification line pressure can be found in Figure 7A1-46. Check each part which is suspected to be the cause.

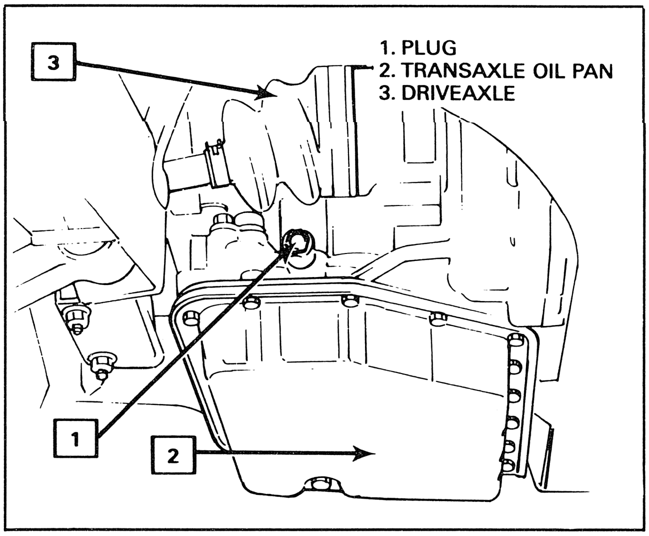


Figure 7A1-44 Plug

STALL TEST

This test is to check the overall performance of the automatic transaxle and engine by measuring stall speed at "D" and "R" ranges.

Engine rpm	Line Pressure	
	"D" range	"R" range (changed)
800 - 900 rpm	2 -4 kg/cm^2 28.5 - 56.8 psi 200 - 400 kPa	5.5 - 8 kg/cm^2 78.3 - 113.7 psi 550 - 800 kPa
2,200 - 2,700 rpm (Stall speed)	4 - 6 kg/cm^2 56.9 - 85.3 psi 400 - 600 kPa	9.0 - 12.5 kg/cm^2 128.0 - 177.8 psi 900 - 1,200 kPa

LC0006-7A1-M-RS

Figure 7A1-45 Line Pressure

NOTICE: Be sure to perform the test only when transaxle fluid is at normal operating temperature. Don't run engine at stall for more than 5 seconds continuously, for oil temperature may rise excessively high.

Test Procedure

1. Install tachometer.
2. Apply parking brake and block vehicle wheels.
3. Start engine with selector lever shifted to "P" range.
4. Depress brake pedal.
5. Shift selector lever to "D" range and depress accelerator pedal fully while watching tachometer. Read quickly the engine rpm when it has become constant (stall speed). Release accelerator pedal immediately after stall speed is checked.
6. In the same way, check stall speed at "R" range.
7. Stall speed should be within 2,200-2,700 rpm.
8. Possible causes for out-of-specification stall speed are shown in Figure 7A1-47. Check each part which is suspected to be the cause.

ROAD TEST

This test is to check if upshifts and downshifts take place at specified speeds while actually driving the vehicle.

Test Procedure

1. Warm up engine.
2. With engine running at idle, shift selector lever to "D" range.
3. Accelerate vehicle speed by depressing accelerator pedal very little.
4. Check if upshift takes place from 1st to 2nd at 14 km/h (9 mile/h) and from 2nd to 3rd at 33 km/h (21 mile/h).
5. Stop vehicle.
6. Accelerate by depressing accelerator pedal fully. Then, check if upshift takes place from 1st to 2nd at 52 km/h (32 mile/h) and from 2nd to 3rd at 97 km/h (60 mile/h).
7. Stop vehicle again.

Line pressure measured	Possible cause
Higher than specification in "D" & "R" ranges	● Regulator valve defective ● Throttle valve defective ● Accelerator cable and oil pressure control cable maladjusted
Lower than specification in "D" & "R" ranges	● Oil pump defective ● Regulator valve defective ● Throttle valve defective ● Accelerator cable and oil pressure control cable maladjusted
Lower than specification only in "D" range	● Forward clutch oil pressure system oil leakage ● "D" range oil pressure system oil leakage
Lower than specification only in "R" range	● Direct clutch oil pressure system oil leakage ● 1st – reverse brake oil pressure system oil leakage ● "R" range oil pressure system oil leakage

Figure 7A1-46 Line Pressure Diagnosis

Stall speed measured	Possible causes
Lower than specification	● Engine output insufficient ● Torque converter defective
Higher than specification in "D" range	● Forward clutch slippage ● One-way clutch defective
Higher than specification in "R" range	● Direct clutch slippage ● 1st – reverse brake slippage

Figure 7A1-47 Stall Speed Results

8. Start vehicle and keep it running at 30 km/h (18 mile/h) and then release accelerator pedal all the way back. 1 or 2 seconds later, depress accelerator pedal fully and check if downshift from 2nd to 1st takes place.
9. Keep vehicle running at 75 km/h (47 mile/h) and in the same way as in step 10, check if downshift from 3rd to 2nd takes place.
10. If upshift or downshift fails to take place at each specified speed in the road test, possible causes for such failure are shown in Figure 7A1-49. Check each part which is suspected to be the cause.

MANUAL ROAD TEST

This test checks the gears being used in "L", "2" or "D" range when driven with unoperated gear shift control system.

Test Procedure

1. With selector lever in "P" range, start engine and warm it up.
2. After warming up engine, disconnect the coupler of solenoid wire as shown in Figure 7A1-49.
3. With selector lever in "L" range, start the vehicle and accelerate to 30 km/h (19 mile/h). Check in this state that 1st gear is being used.

Condition	Possible causes
No upshift from 1st to 2nd	● 1 – 2 shift valve defective ● 2nd brake solenoid defective ● Controller defective, or disconnection or poor connection in controller electric circuit
No upshift from 2nd to 3rd	● 2 – 3 shift valve defective ● Direct clutch solenoid defective ● Controller defective, or disconnection or poor connection in controller electric circuit
No downshift from 2nd to 1st or 3rd to 2nd	● Throttle position sensor defective ● Controller defective, or disconnection or poor connection in controller electric circuit

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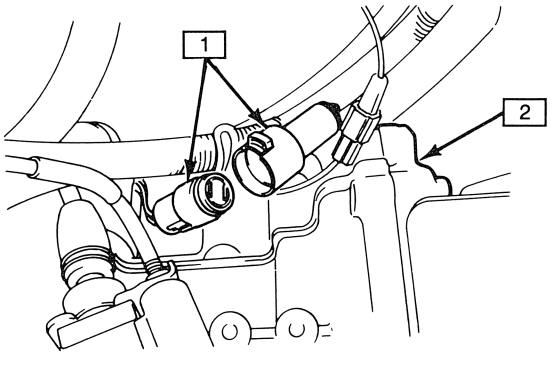
Figure 7A1-48 Road Test Results

4. At 30 km/h (19 mile/h), shift selector lever to "2" range and accelerate to 60 km/h (37 mile/h). Check in this state that 2nd gear is being used.
5. At 60 km/h (37 mile/h), shift selector lever to "D" range and check that 3rd gear is used when speed is higher than 60 km/h (37 mile/h).
6. After above checks, stop vehicle, turn off engine and connect solenoid wire coupler.



1 SOLENOID WIRE COUPLER (DISCONNECTED)
2 TRANSMISSION

LC0013-7A1-M-RS

Figure 7A1-49 Coupler of Solenoid Wire

ENGINE BRAKE TEST

Test Procedure

1. While driving vehicle in 3rd gear of "D" range, shift selector lever down to "2" range and check if engine brake operates.
2. In the same way as in step 1, check engine brake for operation when selector lever is shifted down to "L" range.
3. If engine brake fails to operate in the above tests, possible causes for such failure can be found in Figure 7A1-50. Check each part which is suspected to be the cause.

Condition	Possible cause
Fails to operate when shifted down to "2" range	Second brake defective
Fails to operate when shifted down to "L" range	1st – reverse brake defective

Figure 7A1-50 Engine Brake Test Results

"P" RANGE TEST

Test Procedure

1. Stop the vehicle on a slope, shift selector lever to "P" range and at the same time apply parking brake.
2. After stopping engine, release parking brake lever gradually and check to see that vehicle remains stationary.

GEAR SHIFT CONTROL SYSTEM

Systematic Trouble Shooting

Before performing the systematic trouble shooting described in this section, make sure to check each of the following.

1. Electric circuit of gearshift control system is free from a break, coupler disconnection and poor contact.
2. Each hose of vacuum switches is securely connected.

CHECKING PROCEDURES FOR "A", "B"

Refer to Figure 7A1-55 thru 7A1-64.

Do the following before carrying out A, B, C and D checks described hereunder.

1. Turn ignition switch "OFF".
2. After turning ignition switch "OFF", disconnect controller coupler.

The Figure 7A1-55 shows terminal numbers of the coupler as disconnected from controller viewed from wire harness side. For each check, bring ohmmeter prods in touch with terminals from wire harness side of coupler disconnected.

NEUTRAL SAFETY SWITCH

Neutral Safety Switch Circuit Check

Place selector lever in "P", "R", "N", "D", "2" or "L" range and in each range check for continuity between the terminals of the disconnected controller coupler (on wiring harness side) respectively, see Figure 7A1-68.

Neutral Safety Switch Unit Check

1. Apply parking brake and block vehicle wheels.
2. Shift selector lever as described in the following steps. With selector lever in "P" or "N" range, depending on each step, turn starter switch "ON" and check that the starter motor operates.
   a. Shift selector lever to "P" range and turn ignition switch "ON".
   b. Shift selector lever from "P" to "N" and turn ignition switch "ON".
   c. Shift selector lever from "N" to "L", then back to "N" again and turn ignition switch "ON".
   d. Shift selector lever from "N" back to "P" and turn ignition switch "ON".
3. If found faulty in any one of a, b, c or d checks in the above step, 2 nuts of manual shift lever may possibly be loose. Retighten both nuts and then perform checks in step 2 again.
4. After checks in step 2, shift selector lever to "D", "2", "L" and "R" one after another. In each of these ranges, turn ignition switch "ON" and check that this doesn't cause starter motor to operate.

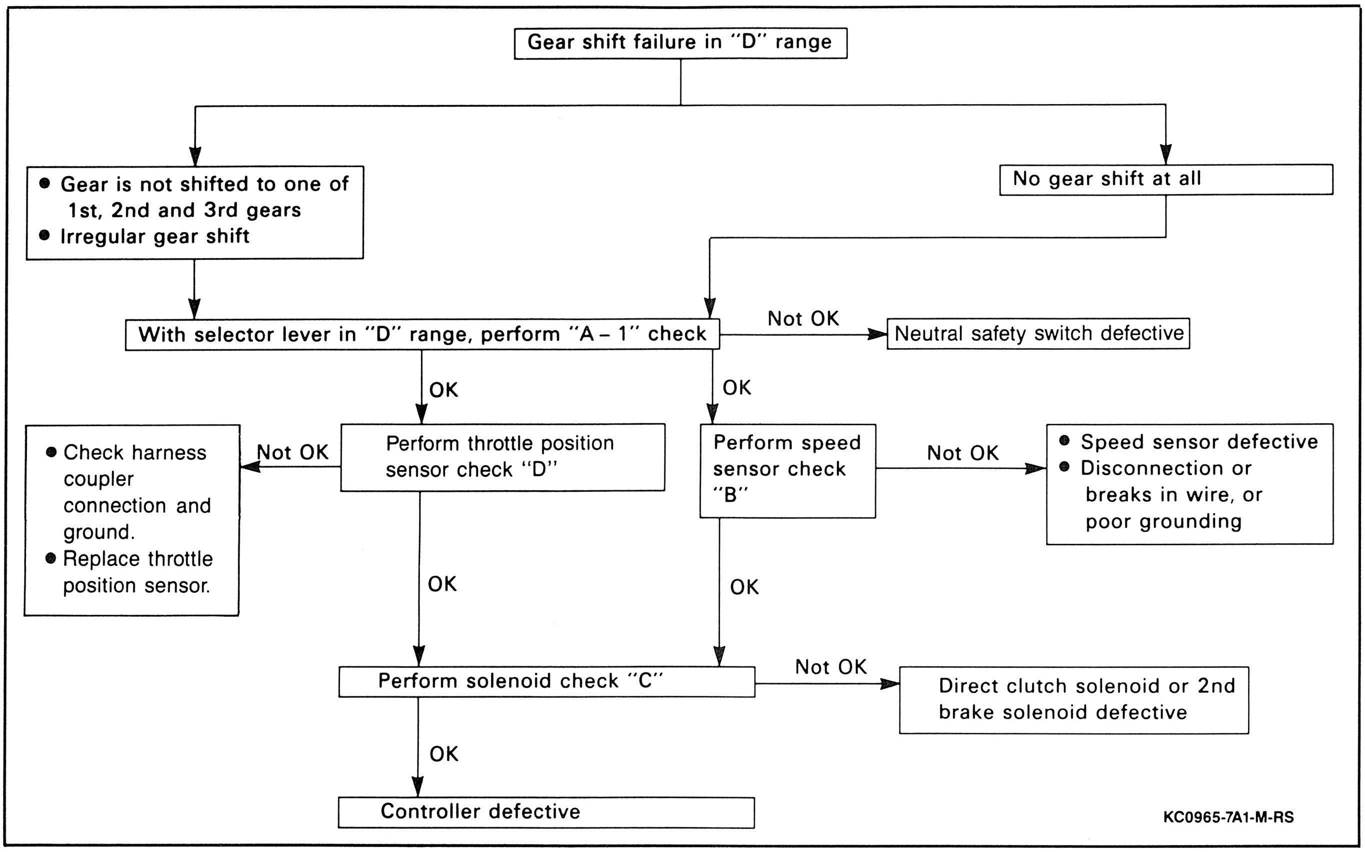

Gear shift failure in "D" range
● Gear is not shifted to one of 1st, 2nd and 3rd gears
● Irregular gear shift
No gear shift at all
With selector lever in "D" range, perform "A – 1" check
Not OK
Neutral safety switch defective
OK
OK
● Check harness coupler connection and ground.
● Replace throttle position sensor.
Not OK
Perform throttle position sensor check "D"
Perform speed sensor check "B"
Not OK
● Speed sensor defective
● Disconnection or breaks in wire, or poor grounding
OK
OK
Perform solenoid check "C"
Not OK
Direct clutch solenoid or 2nd brake solenoid defective
OK
Controller defective
KC0965-7A1-M-RS

Figure 7A1-51 Systematic Trouble Shooting (1)

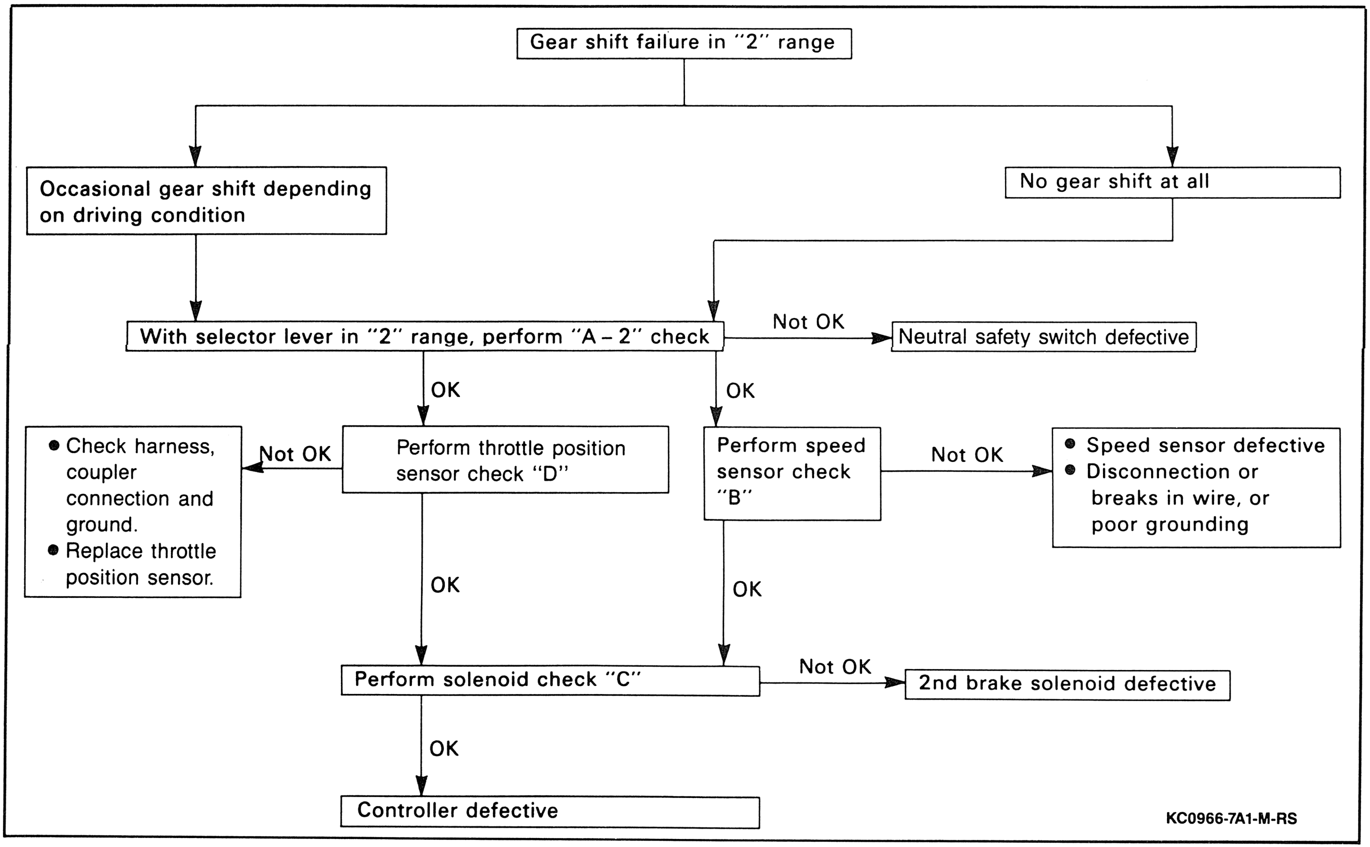

Gear shift failure in "2" range
Occasional gear shift depending on driving condition
No gear shift at all
With selector lever in "2" range, perform "A – 2" check
Not OK
Neutral safety switch defective
OK
OK
● Check harness, coupler connection and ground.
● Replace throttle position sensor.
Not OK
Perform throttle position sensor check "D"
Perform speed sensor check "B"
Not OK
● Speed sensor defective
● Disconnection or breaks in wire, or poor grounding
OK
OK
Perform solenoid check "C"
Not OK
2nd brake solenoid defective
OK
Controller defective
KC0966-7A1-M-RS

Figure 7A1-52 Systematic Trouble Shooting (2)

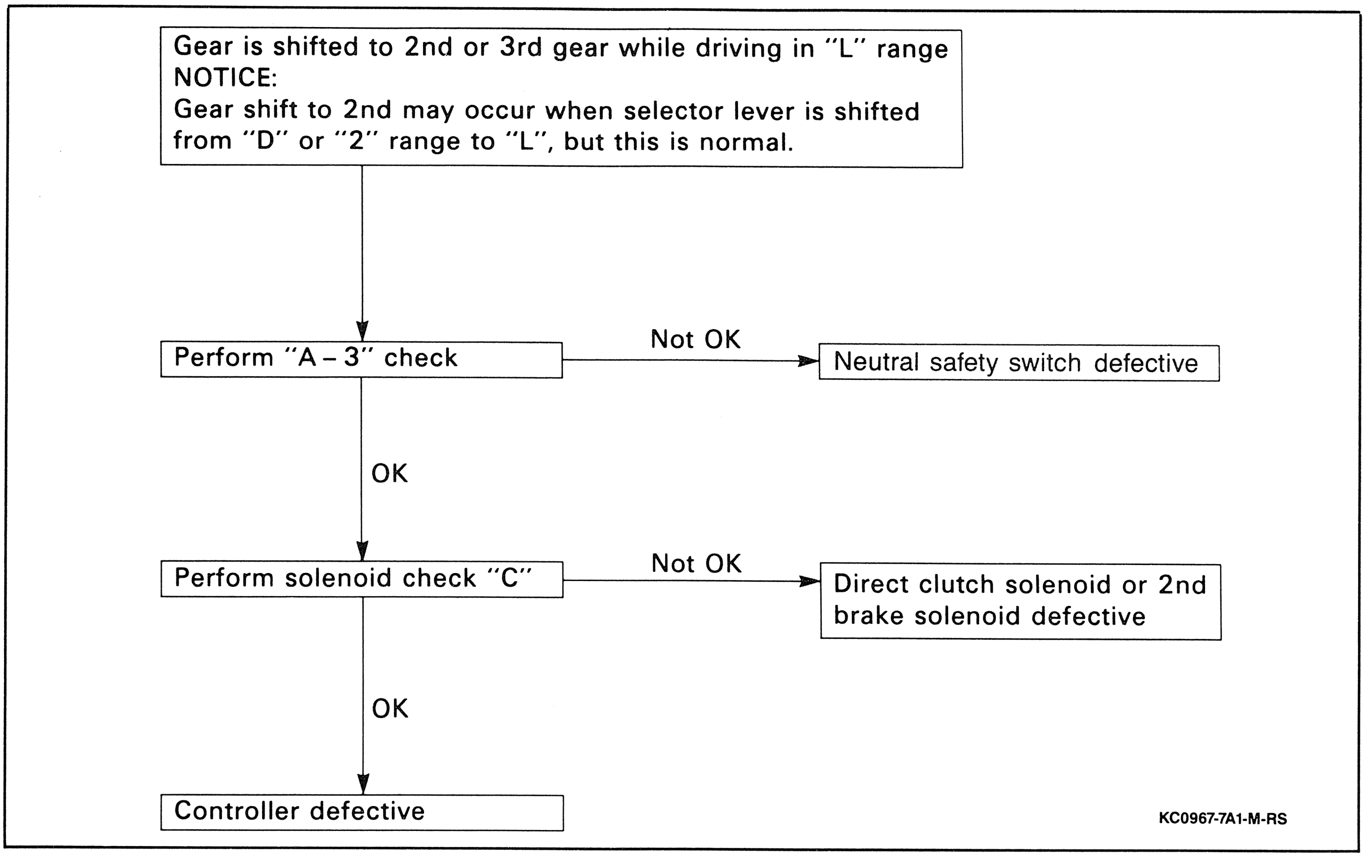

Gear is shifted to 2nd or 3rd gear while driving in "L" range
NOTICE:
Gear shift to 2nd may occur when selector lever is shifted from "D" or "2" range to "L", but this is normal.
Perform "A – 3" check
Not OK
Neutral safety switch defective
OK
Perform solenoid check "C"
Not OK
Direct clutch solenoid or 2nd brake solenoid defective
OK
Controller defective
KC0967-7A1-M-RS

Figure 7A1-53 Systematic Trouble Shooting (3)

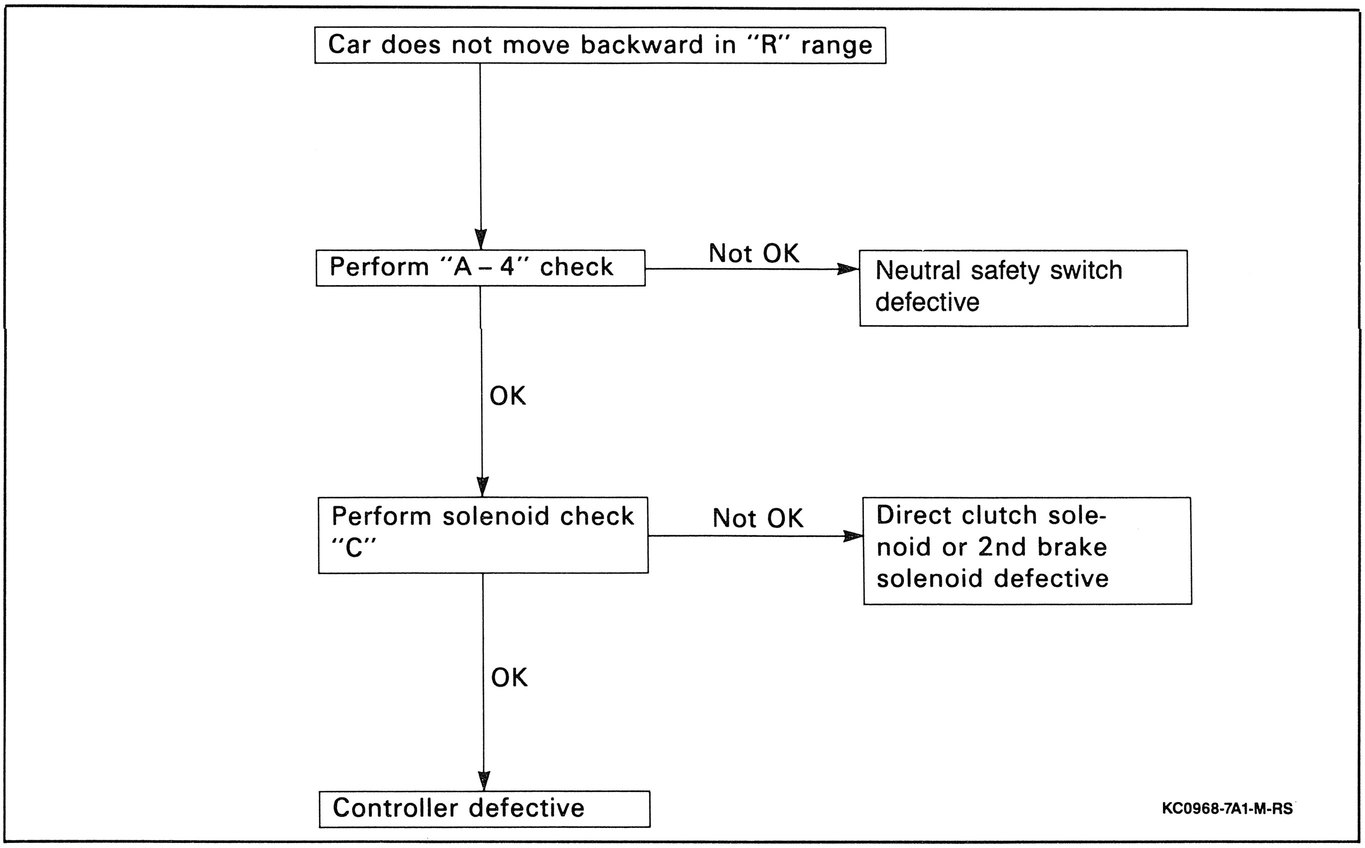

Car does not move backward in "R" range
Perform "A – 4" check
Not OK
Neutral safety switch defective
OK
Perform solenoid check "C"
Not OK
Direct clutch solenoid or 2nd brake solenoid defective
OK
Controller defective
KC0968-7A1-M-RS

Figure 7A1-54 Systematic Trouble Shooting (4)

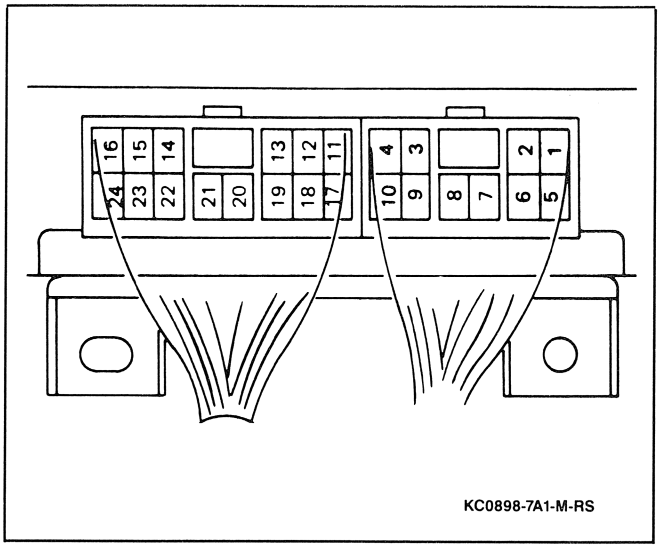

16
15
14
13
12
11
4
3
2
1
24
23
22
21
20
19
18
17
10
9
8
7
6
5
KC0898-7A1-M-RS

Figure 7A1-55 Coupler Terminals Numbers (Viewed from Wire Harness Side)

5. If failure is not corrected even after retightening 2 nuts as described in step 3 or found faulty in step 4, loosen neutral safety switch mounting bolt and then, with selector lever shifted to "N" range, move neutral safety switch by hand as shown in Figure 7A1-67. Stop the neutral safety switch at the position where a "Click" is heard from the switch, and then, retighten the mounting bolt. Be sure to perform checks in steps 2 and 4 after retightening mounting bolt.
6. If faulty condition still exists even after adjusting neutral safety switch position as described in step 5, there may possibly be a poor contact within neutral safety switch.

Check for continuity in switch as follows.

a. Disconnect 2 couplers of neutral safety switch.
b. Shift selector lever to each range. In each range, check continuity between the neutral safety switch coupler wires shown in Figure 7A1-68 by using an ohmmeter. If found faulty, replace neutral safety switch.

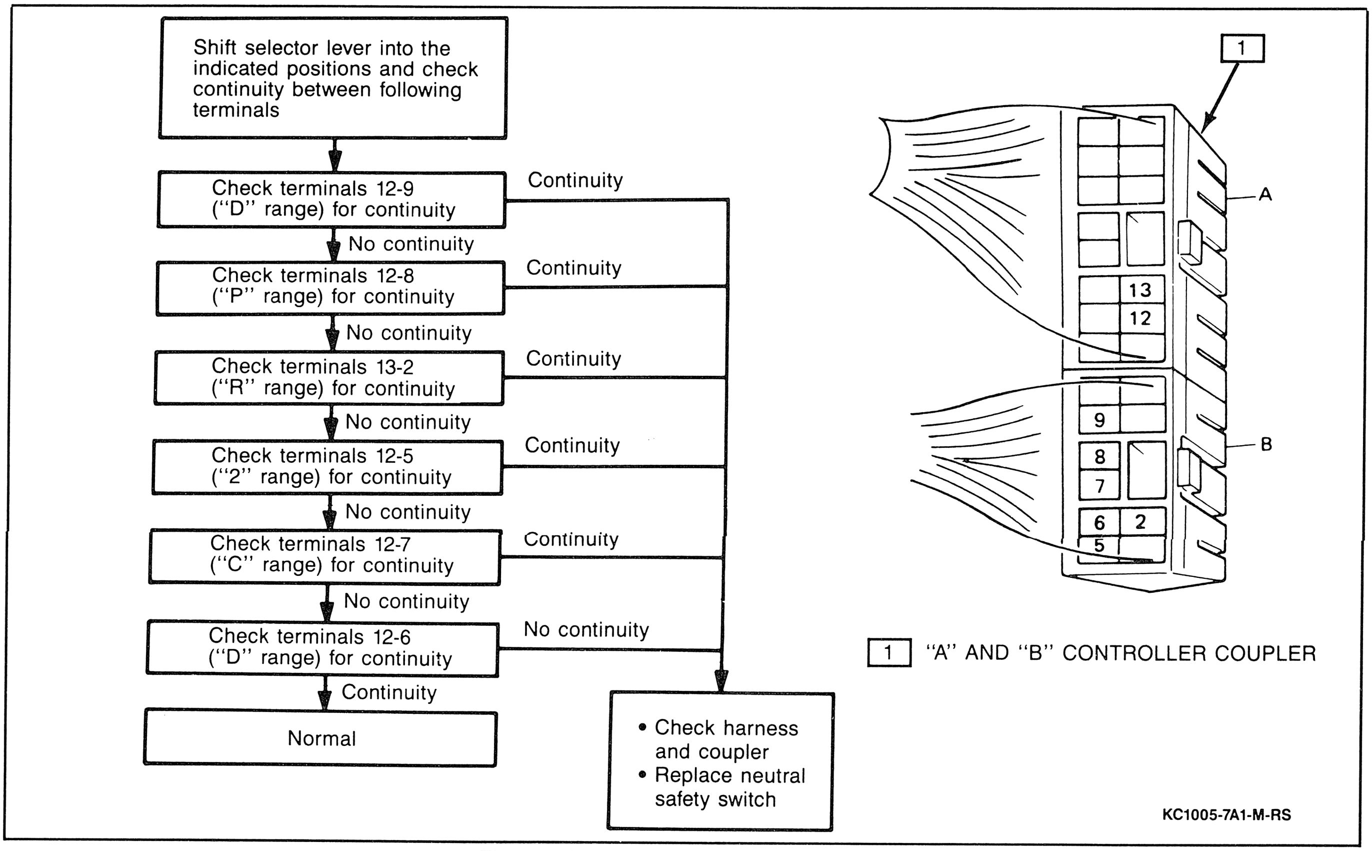

Shift selector lever into the indicated positions and check continuity between following terminals
Check terminals 12-9 ("D" range) for continuity
Continuity
No continuity
Check terminals 12-8 ("P" range) for continuity
Continuity
No continuity
Check terminals 13-2 ("R" range) for continuity
Continuity
No continuity
Check terminals 12-5 ("2" range) for continuity
Continuity
No continuity
Check terminals 12-7 ("C" range) for continuity
Continuity
No continuity
Check terminals 12-6 ("D" range) for continuity
No continuity
Continuity
Normal
• Check harness and coupler
• Replace neutral safety switch
1
A
B
13
12
9
8
7
6
2
5
1 "A" AND "B" CONTROLLER COUPLER
KC1005-7A1-M-RS

Figure 7A1-56 "A-1" Check Procedure

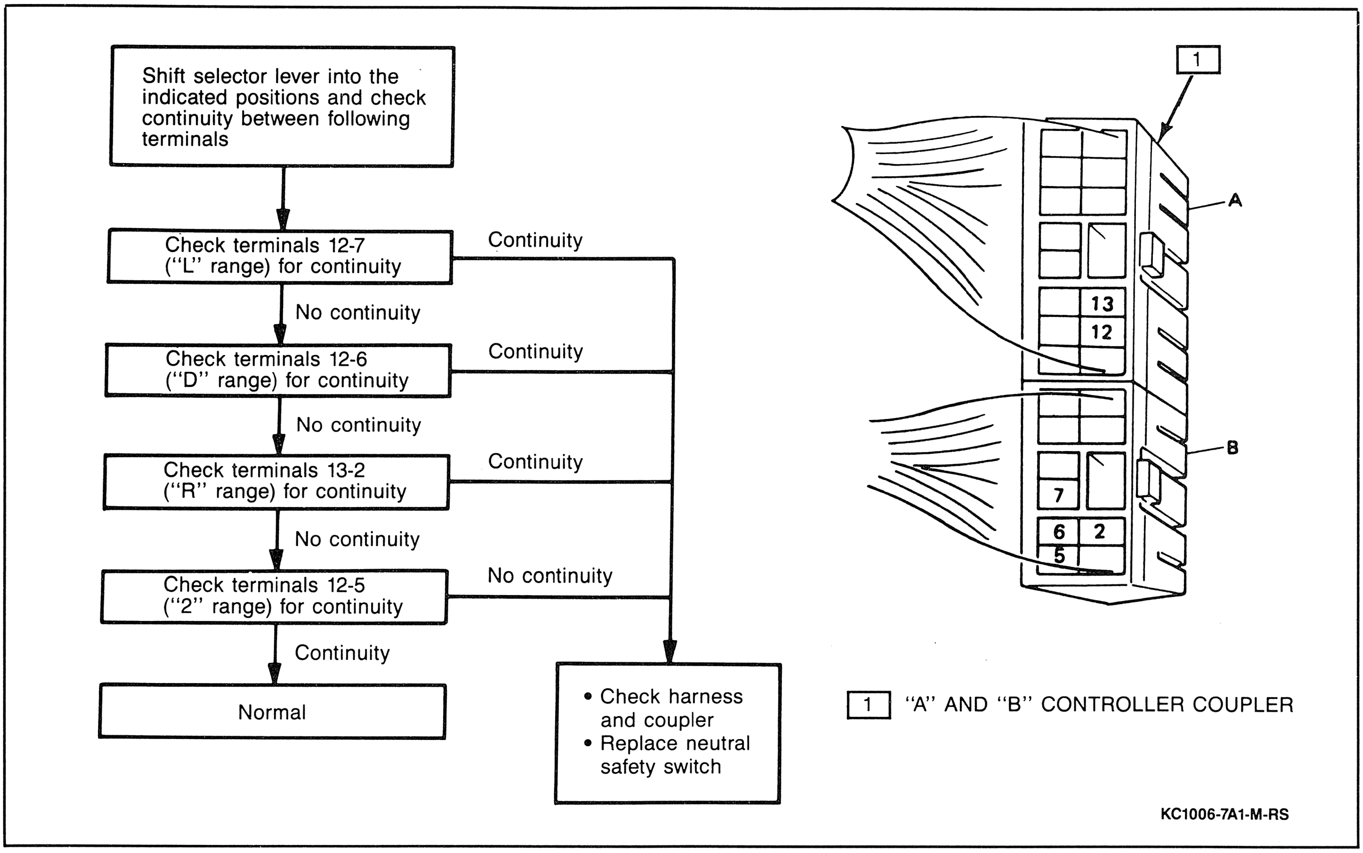

Shift selector lever into the indicated positions and check continuity between following terminals
Check terminals 12-7 ("L" range) for continuity
Continuity
No continuity
Check terminals 12-6 ("D" range) for continuity
Continuity
No continuity
Check terminals 13-2 ("R" range) for continuity
Continuity
No continuity
Check terminals 12-5 ("2" range) for continuity
No continuity
Continuity
Normal
• Check harness and coupler
• Replace neutral safety switch
1
A
13
12
B
7
6
2
5
1 "A" AND "B" CONTROLLER COUPLER
KC1006-7A1-M-RS

Figure 7A1-57 "A-2" Check Procedure

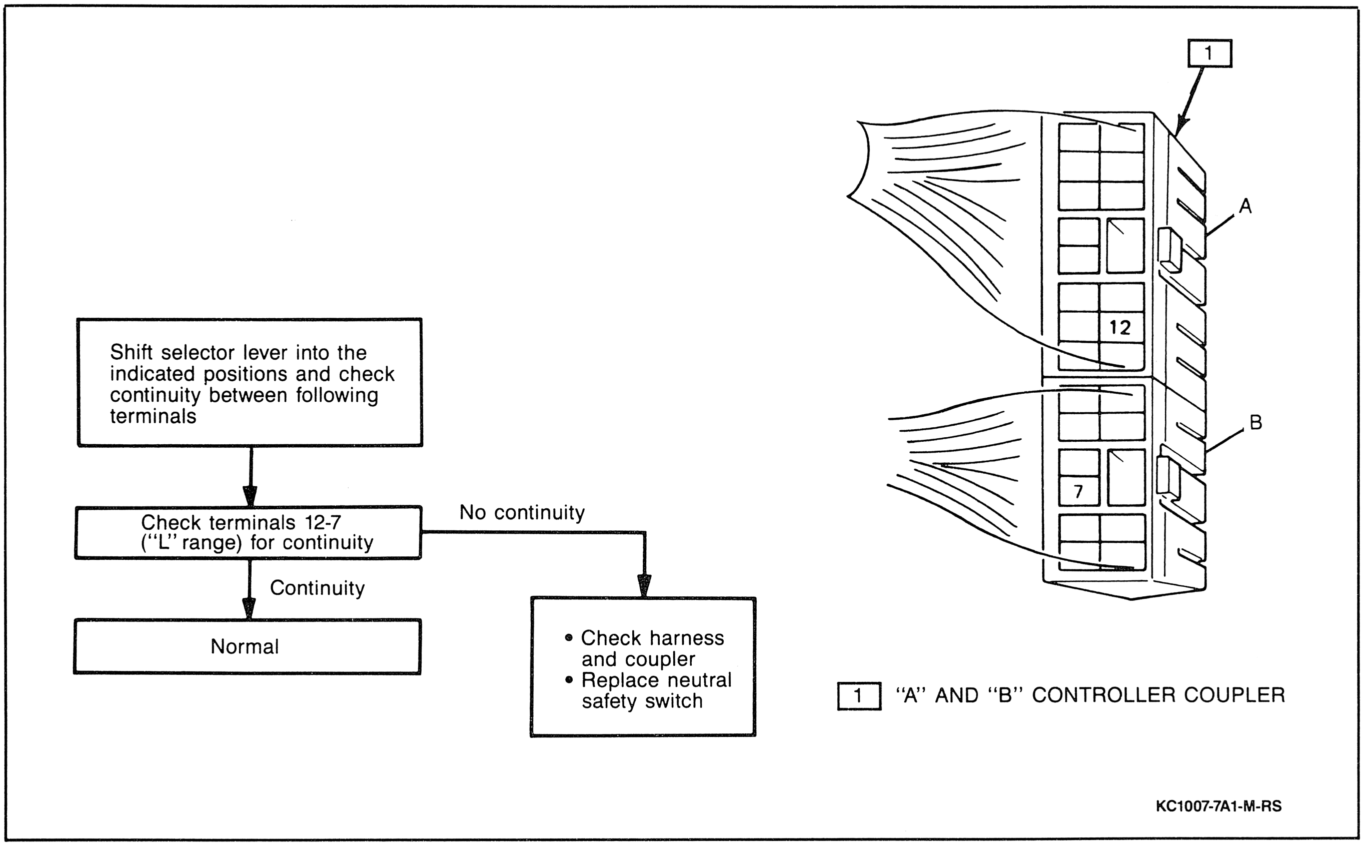

1
A
12
B
7
Shift selector lever into the indicated positions and check continuity between following terminals
Check terminals 12-7 ("L" range) for continuity
No continuity
Continuity
Normal
• Check harness and coupler
• Replace neutral safety switch
1 "A" AND "B" CONTROLLER COUPLER
KC1007-7A1-M-RS

Figure 7A1-58 "A-3" Check Procedure

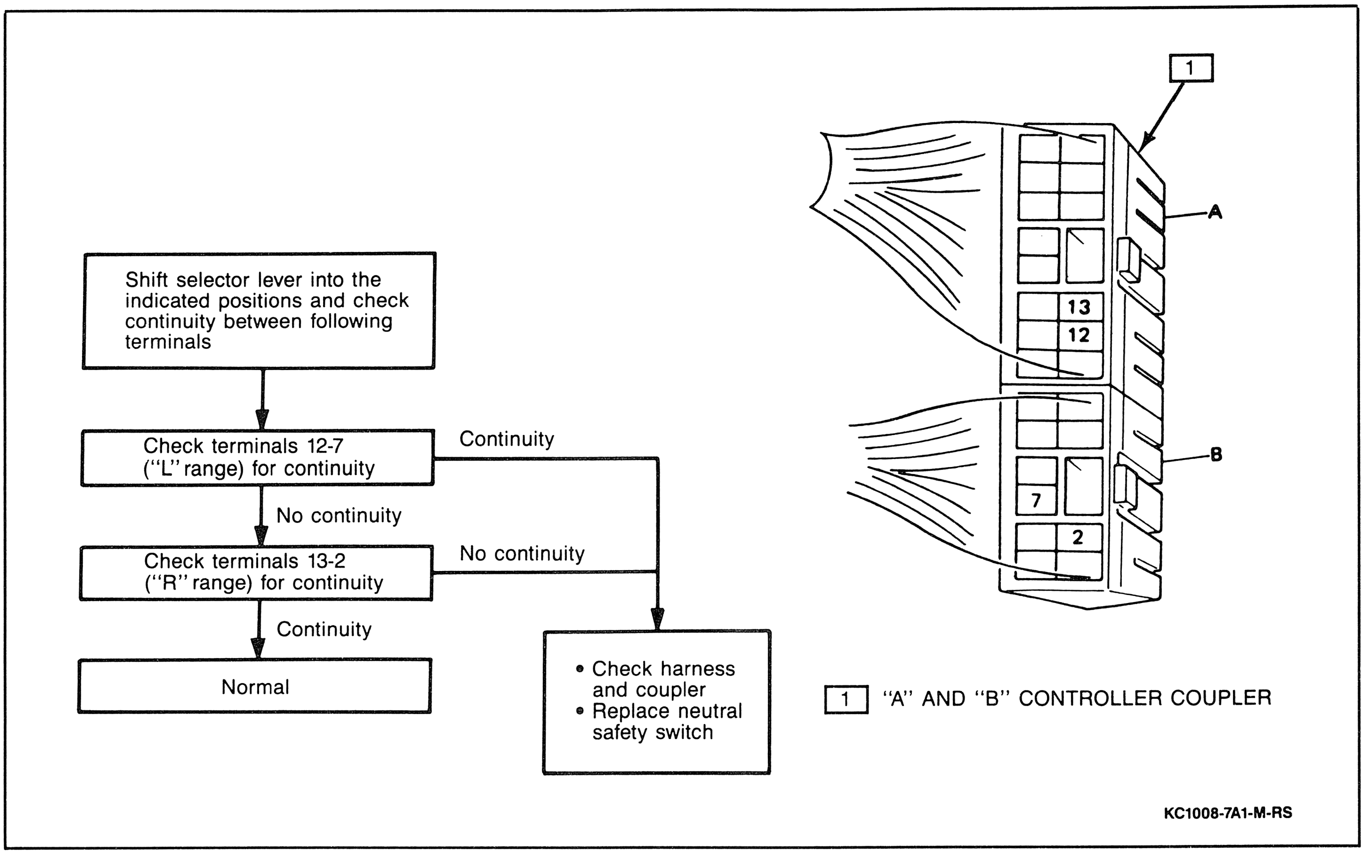

Shift selector lever into the indicated positions and check continuity between following terminals
Check terminals 12-7 ("L" range) for continuity
Continuity
No continuity
Check terminals 13-2 ("R" range) for continuity
No continuity
Continuity
Normal
• Check harness and coupler
• Replace neutral safety switch
1
A
13
12
B
7
2
1 "A" AND "B" CONTROLLER COUPLER
KC1008-7A1-M-RS

Figure 7A1-59 "A-4" Check Procedure

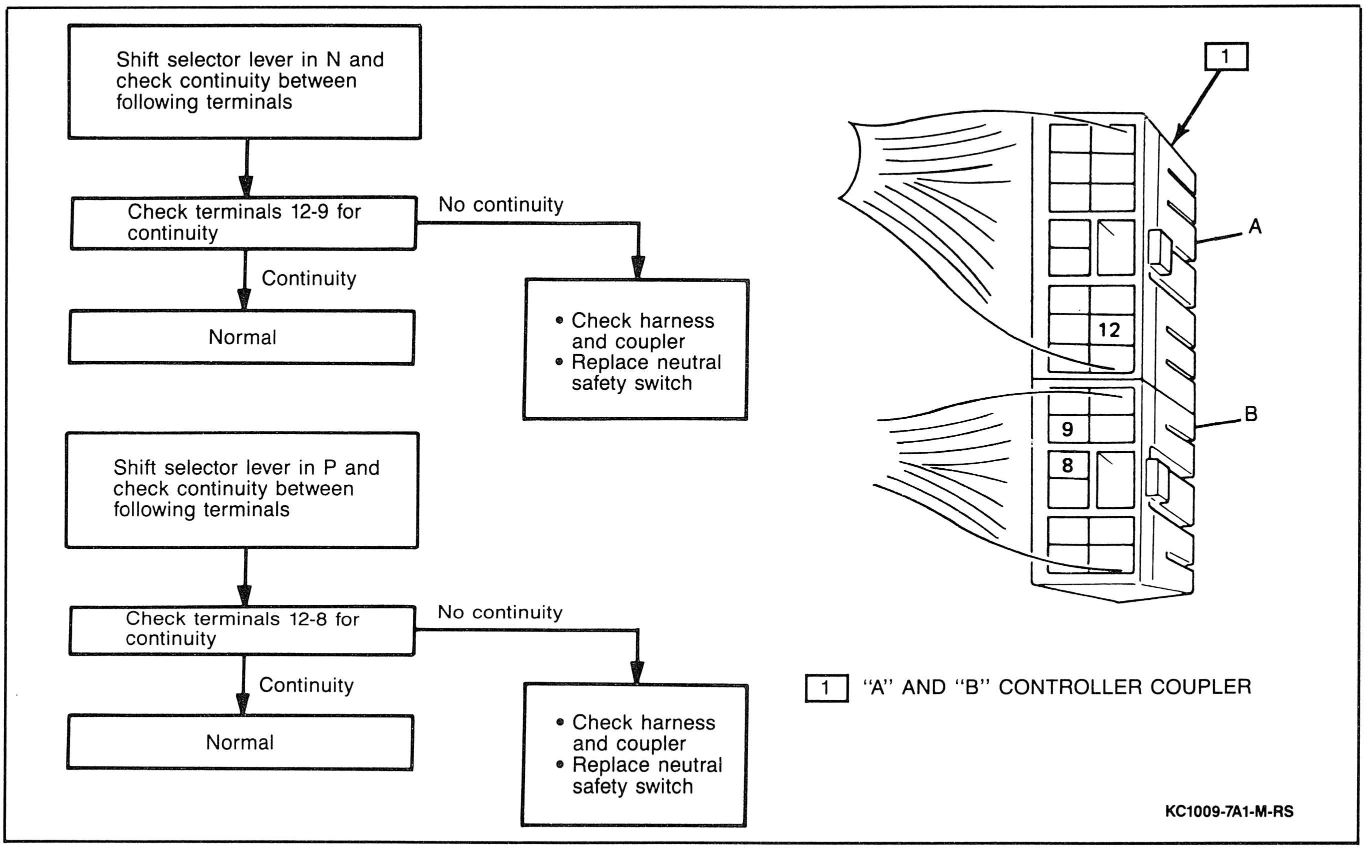

Shift selector lever in N and check continuity between following terminals
Check terminals 12-9 for continuity
No continuity
Continuity
Normal
• Check harness and coupler
• Replace neutral safety switch
Shift selector lever in P and check continuity between following terminals
Check terminals 12-8 for continuity
No continuity
Continuity
Normal
• Check harness and coupler
• Replace neutral safety switch
1
A
12
B
9
8
1 "A" AND "B" CONTROLLER COUPLER
KC1009-7A1-M-RS

Figure 7A1-60 "B" Check Procedure

DIRECT CLUTCH AND 2ND BRAKE SOLENOIDS

Solenoid Circuit Check

1. With ignition switch turned "OFF", disconnect controller coupler.
2. Measure resistance between the coupler terminals 14 and 12 for the direct clutch and terminals 16 and 12 for the 2nd brake solenoid circuit. Both circuits should register about 13 ohms.

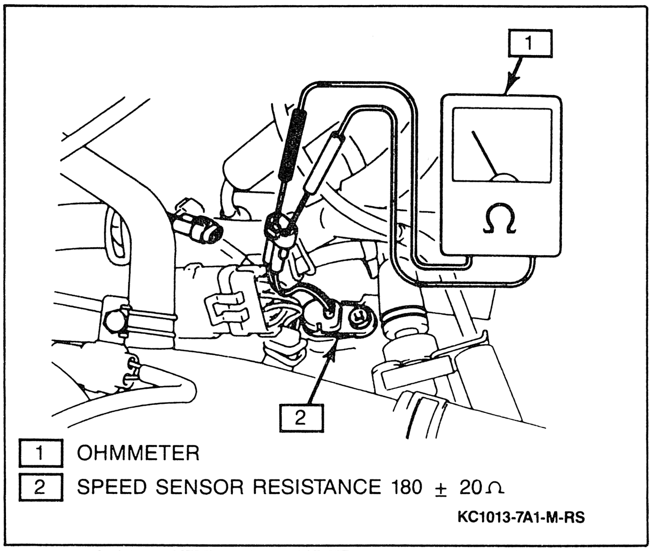

1
Ω
2
1 OHMMETER
2 SPEED SENSOR RESISTANCE 180 ± 20Ω
KC1013-7A1-M-RS

Figure 7A1-61 Checking Speed Sensor

Solenoid Unit Check

1. Drain fluid from transaxle.
2. Remove transaxle oil pan.
3. Disconnect solenoid couplers at each solenoid.
4. Connect ohmmeter between solenoid terminal and solenoid body and measure solenoid resistance. If about 13 ohms resistance exists, solenoid is in good condition.
5. Connect positive terminal of 12V battery to solenoid terminal and negative terminal to solenoid body. Check that a "click" of valve operation is heard from solenoid when connection is made (Figure 7A1-63).

NOTICE: Make sure not to reverse positive and negative terminals of battery when connecting them to solenoid.

6. If found faulty in step 4 or 5, replace solenoid.
7. After checking, connect coupler to solenoid.
8. After installing oil pan, refill transaxle.

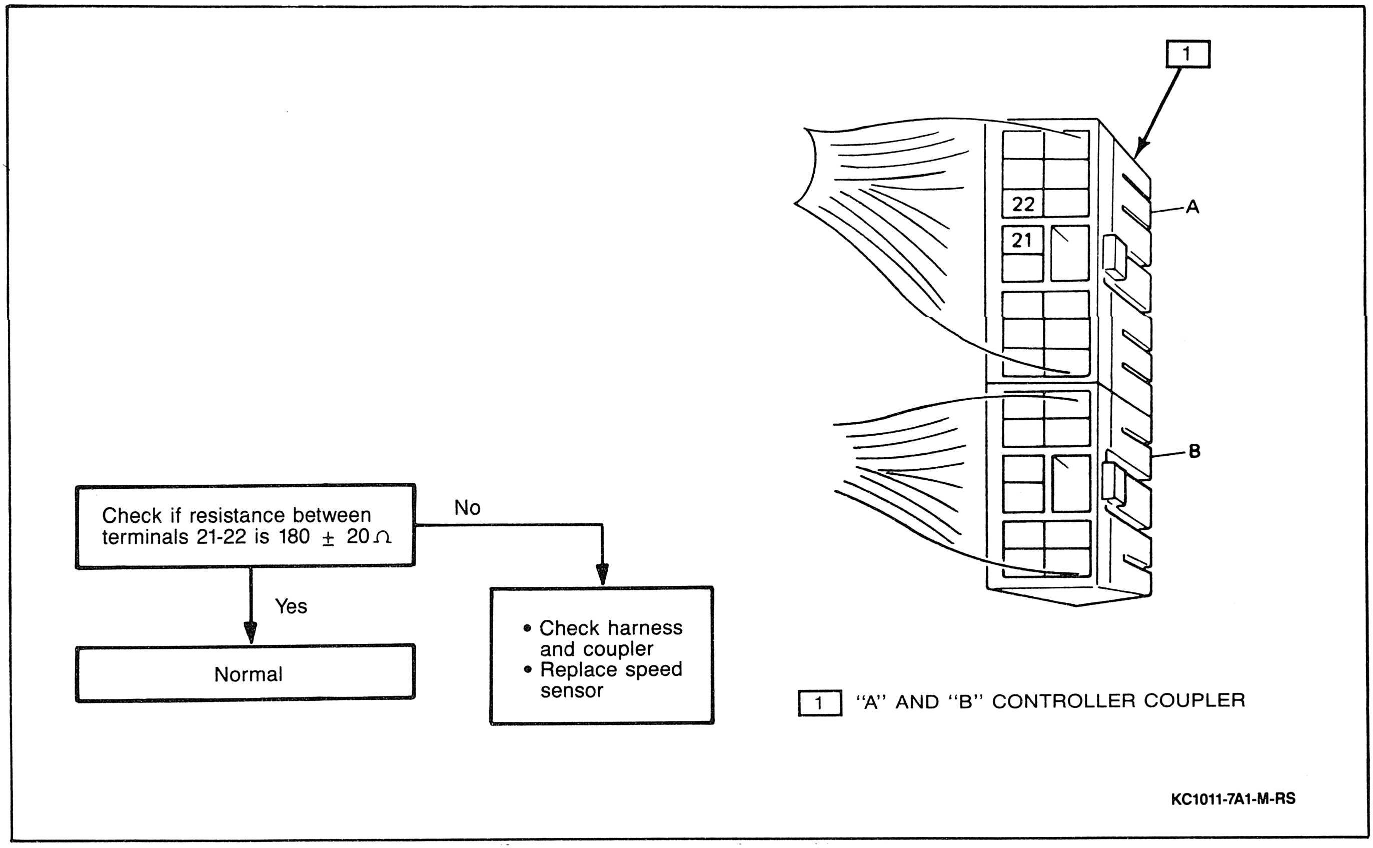
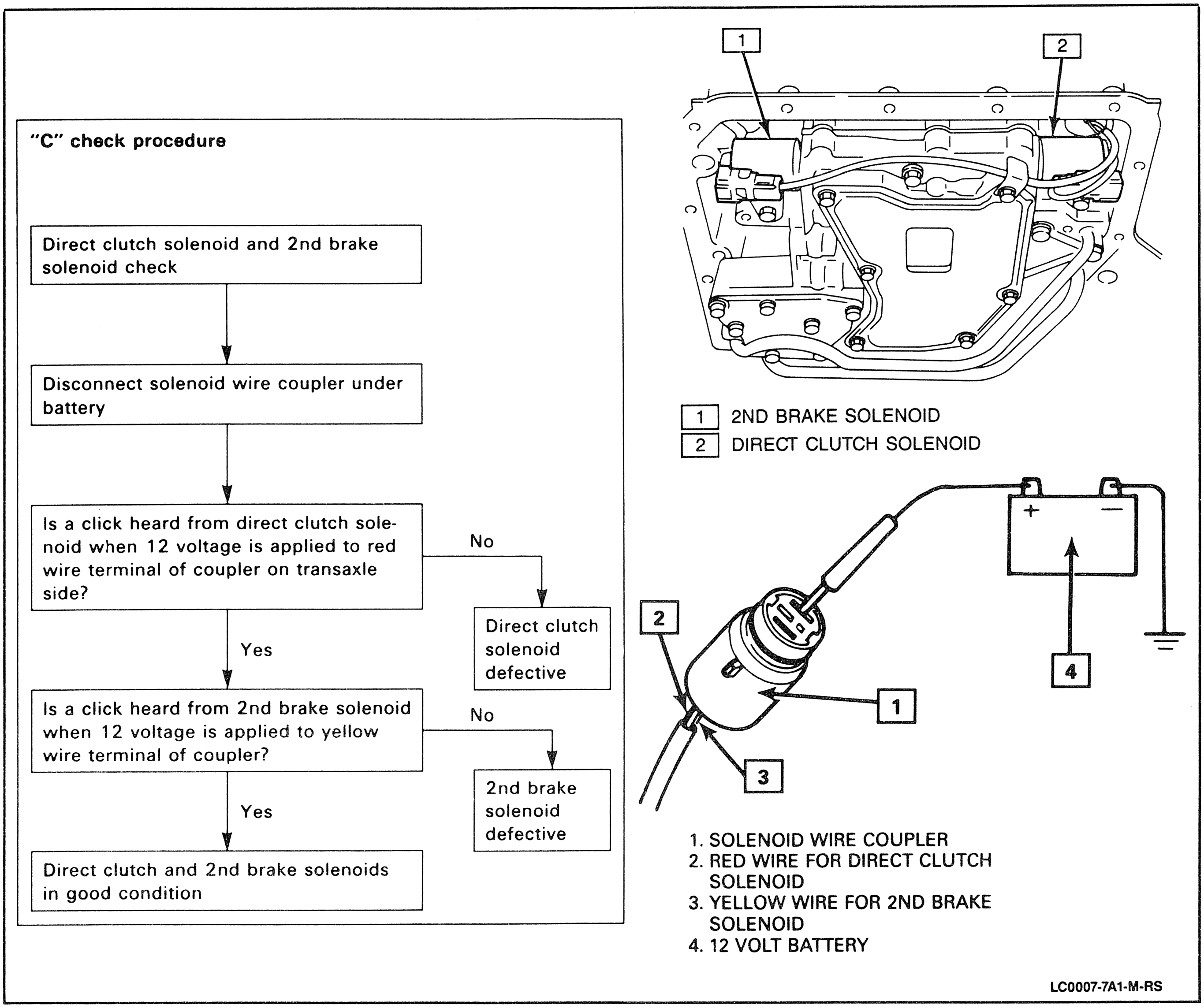

Check if resistance between terminals 21-22 is 180 ± 20Ω
No
Yes
Normal
• Check harness and coupler
• Replace speed sensor
1
22
21
A
B
1 "A" AND "B" CONTROLLER COUPLER
KC1011-7A1-M-RS

Figure 7A1-62 Speed Sensor Check



"C" check procedure

Direct clutch solenoid and 2nd brake solenoid check

Disconnect solenoid wire coupler under battery

Is a click heard from direct clutch solenoid when 12 voltage is applied to red wire terminal of coupler on transaxle side?

No → Direct clutch solenoid defective

Yes

Is a click heard from 2nd brake solenoid when 12 voltage is applied to yellow wire terminal of coupler?

No → 2nd brake solenoid defective

Yes

Direct clutch and 2nd brake solenoids in good condition

1 2ND BRAKE SOLENOID
2 DIRECT CLUTCH SOLENOID

1. SOLENOID WIRE COUPLER
2. RED WIRE FOR DIRECT CLUTCH SOLENOID
3. YELLOW WIRE FOR 2ND BRAKE SOLENOID
4. 12 VOLT BATTERY

LC0007-7A1-M-RS

Figure 7A1-63 "C" Check Procedure

THROTTLE VALVE OPENING SIGNAL CHECK PROCEDURE "D"

1. Disconnect coupler(s) from A/T control module.
2. Bring voltmeter probes in touch with coupler terminals from harness side (Figure 7A1-64).

SPEED SENSOR UNIT CHECK

1. Turn OFF ignition switch.
2. Disconnect coupler(s) from control module.
3. Using ohmmeter probes, touch coupler terminals 22 and 21 (Figure 7A1-62).
4. The speed sensor can be checked separately from the unit check by measuring the resistance at the speed sensor sending unit coupler at transaxle (Figure 7A1-61).

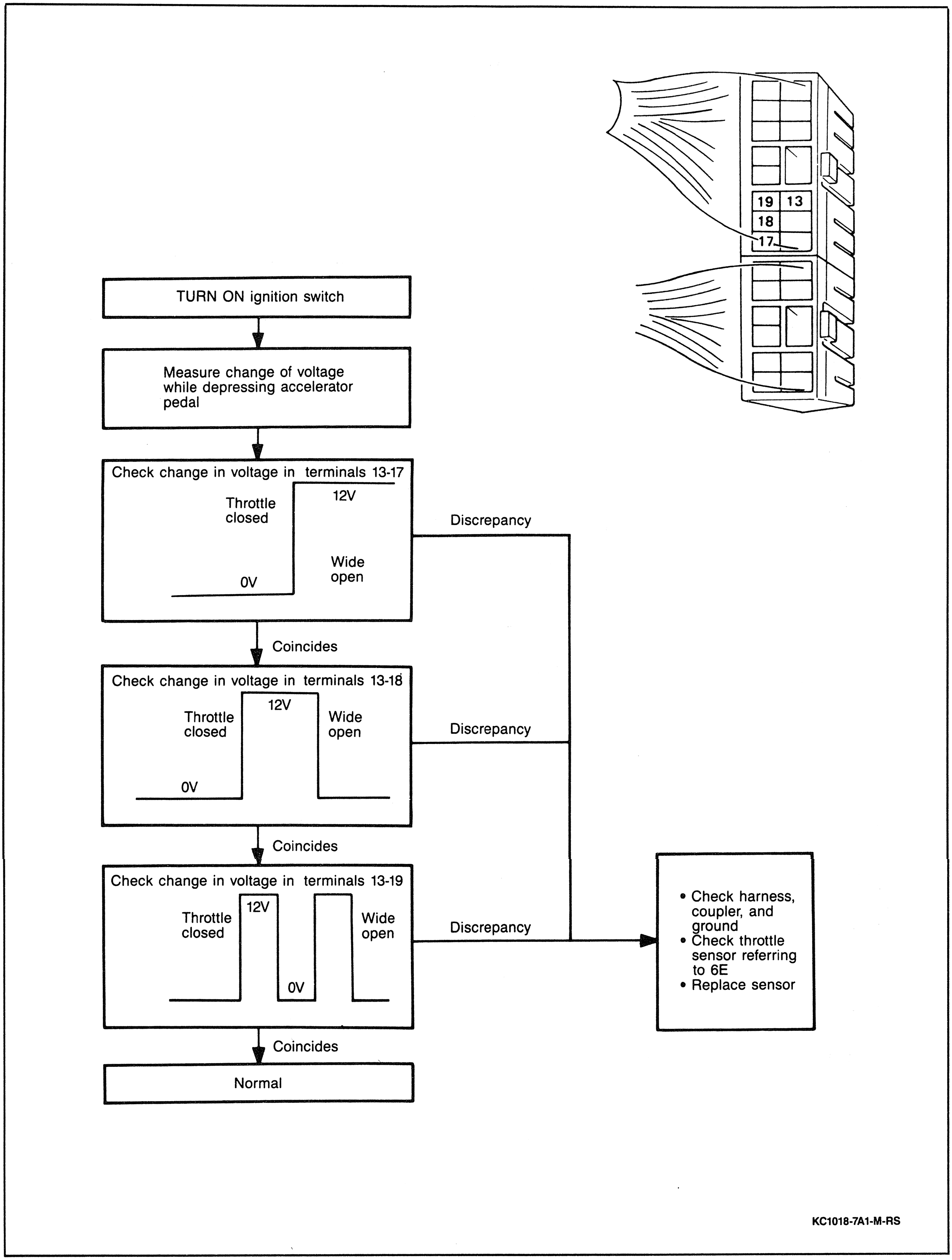
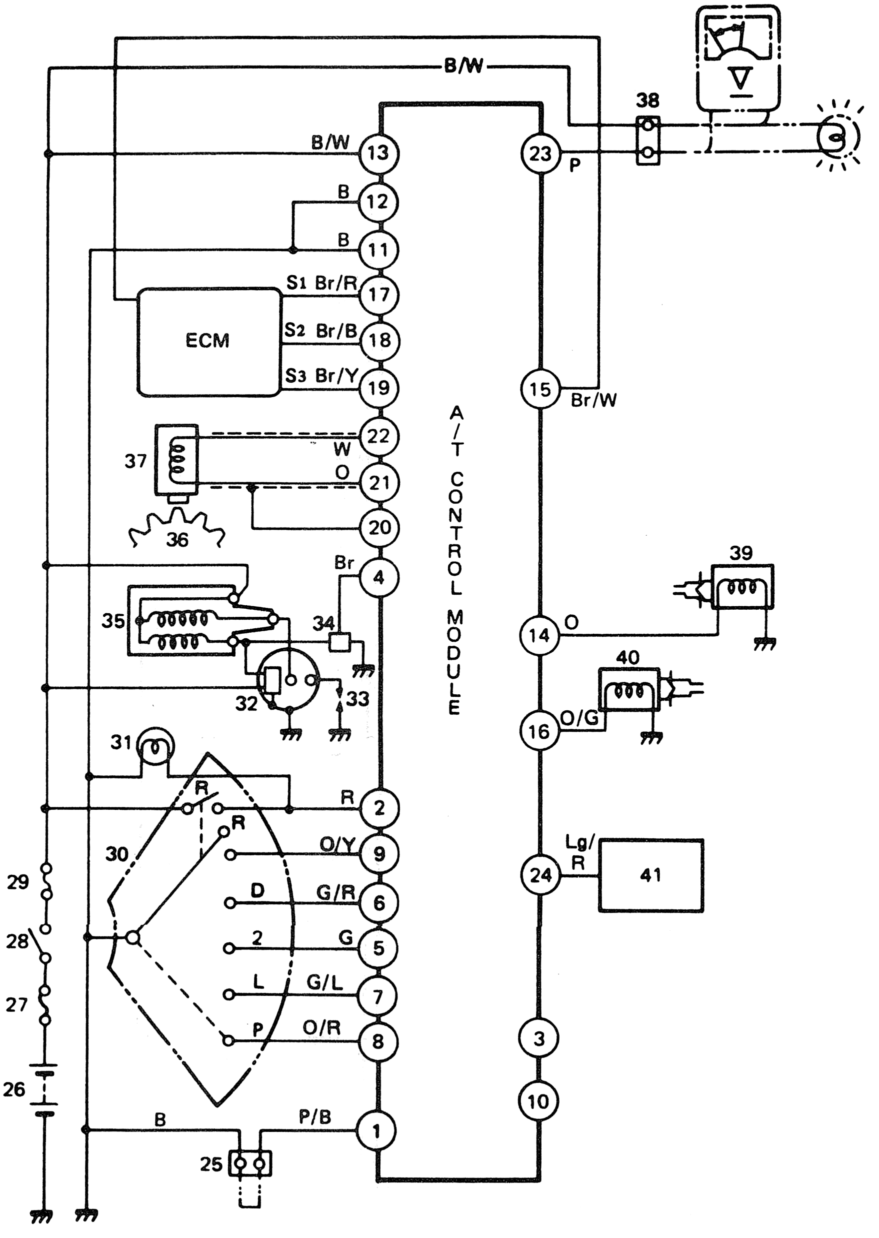

19
13
18
17
TURN ON ignition switch
Measure change of voltage while depressing accelerator pedal
Check change in voltage in terminals 13-17
Throttle closed
12V
0V
Wide open
Discrepancy
Coincides
Check change in voltage in terminals 13-18
Throttle closed
12V
Wide open
0V
Discrepancy
Coincides
Check change in voltage in terminals 13-19
Throttle closed
12V
Wide open
0V
Discrepancy
Coincides
Normal
• Check harness, coupler, and ground
• Check throttle sensor referring to 6E
• Replace sensor
KC1018-7A1-M-RS

Figure 7A1-64 "D" Check Procedure

WIRING DIAGRAM OF GEAR SHIFT CONTROL SYSTEM

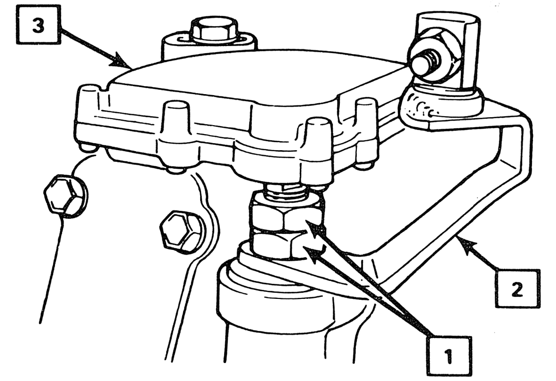
This Figure shows the electrical circuit of the gear shift control system. Referring to this diagram, check each circuit of switches, solenoids, and sensors for disconnection and poor contact.

1. DIAGNOSIS SWITCH
2. R POSITION
3. NO CONNECTION
4. IGNITION SIGNAL
5. 2ND POSITION
6. D POSITION
7. L POSITION
8. P POSITION
9. N POSITION
10. NO CONNECTION
11. GROUND
12. GROUND
13. POWER SUPPLY
14. DIRECT CLUTCH SOLENOID
15. R, D, 2 AND L SIGNAL
16. 2ND BRAKE SOLENOID
17. THROTTLE OPENING SIGNAL
18. THROTTLE OPENING SIGNAL
19. THROTTLE OPENING SIGNAL
20. SPEED SENSOR GROUND
21. SPEED SENSOR
22. SPEED SENSOR
23. DIAGNOSIS MONITOR
24. AIR-CON CONTROL
25. DIAGNOSIS SWITCH
26. BATTERY
27. MAIN FUSE
28. IGNITION SWITCH
29. FUSE
30. SHIFT LEVER SWITCH
31. BACKUP LAMP
32. DISTRIBUTOR
33. SPARK PLUG
34. NOISE FILTER
35. IGNITION COIL
36. COUNTERSHAFT
37. SPEED SENSOR
38. DIAGNOSIS MONITOR
39. DIRECT CLUTCH SOLENOID
40. 2ND BRAKE SOLENOID
41. AIR-CON CONTROLLER


B/W
38
B/W
13
23
P
B
12
B
11
S1 Br/R
17
ECM
S2 Br/B
18
S3 Br/Y
19
15
Br/W
A/T CONTROL MODULE
37
22
W
O
21
20
36
Br
4
39
35
34
14
O
40
32
33
16
O/G
31
R
R
2
R
30
O/Y
9
Lg/R
24
41
29
D
G/R
6
28
2
G
5
L
G/L
7
27
P
O/R
8
3
26
10
B
P/B
1
25

KC0998-7A1-M-RS

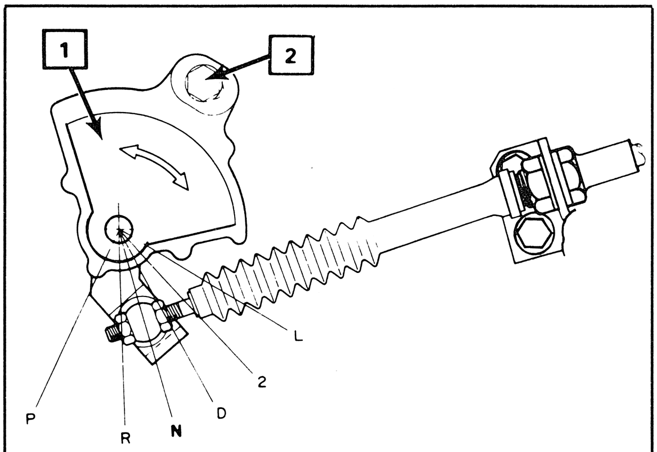
Figure 7A1-65 Wiring Diagram of Gear Shift Control System



1 MANUAL SHIFT LEVER NUTS
2 MANUAL SHIFT LEVER
3 NEUTRAL SAFETY SWITCH

KC0970-7A1-M-RS

Figure 7A1-66 Manual Shift Lever Nuts

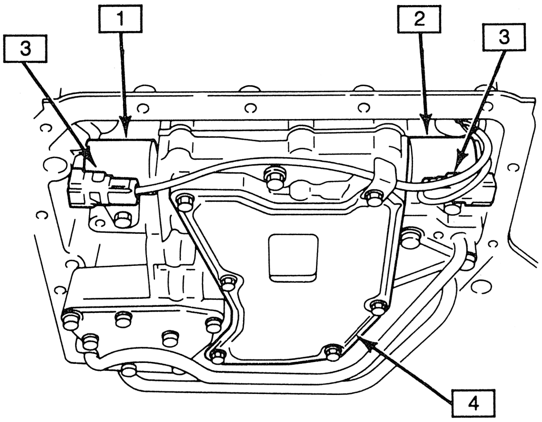


1 NEUTRAL SAFETY SWITCH
2 MOUNTING BOLT

KC0969-7A1-M-RS

Figure 7A1-67 Adjusting Neutral Safety Switch Position

Solenoid	Coupler terminal numbers to connect ohmmeter to:	Resistance
Direct clutch	14 – 12	13Ω
2nd brake	16 – 12	13Ω



1 2ND BRAKE SOLENOID
2 DIRECT CLUTCH SOLENOID
3 SOLENOID COUPLERS
4 OIL STRAINER

LC0008-7A1-M-RS

Figure 7A1-69 Solenoid Couplers

Position	Neutral Safety Switch Lead Wire Color									
	Black	Blue/ White	Blue	Green	Green/ Red	Green/ Blue	Red	Yellow	Black/ Red	Black/ Yellow
P	○	○							○	○
R							○	○		
N	○	─	○						○	○
D	○	─	─	○						
2	○	─	─	─	○					
L	○	─	─	─	─	○				

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Figure 7A1-68 Wire Chart

UNIT REPAIR

DISASSEMBLY OF TRANSAXLE

NOTICE: Before overhauling the transaxle, clean it thoroughly to protect its inner parts against dust and dirt during overhaul. When placing the removed transaxle on a work table, be sure not to damage the outside parts of the transaxle. Use special care for gasket removal. Gasket must be removed completely and gasket surface must not be damaged.

Remove or Disconnect

1. Torque converter.

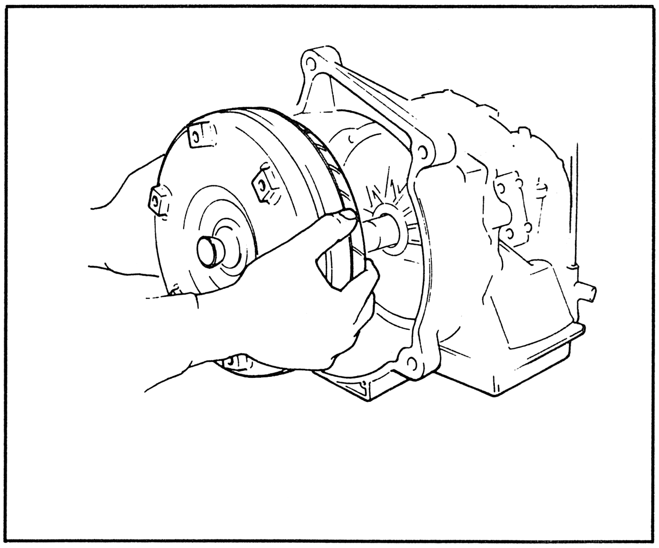


Figure 7A1-70 Removing Torque Converter

2. Five (5) rear cover bolts and two (2) solenoid wire harness clamps (Figure 7A1-83). Install transaxle holding fixture J-35525 (Figure 7A1-71).
3. Oil lever gage, filler tube and oil cooler lines.
4. Drain transaxle fluid.
5. Oil pan and oil pan gasket.

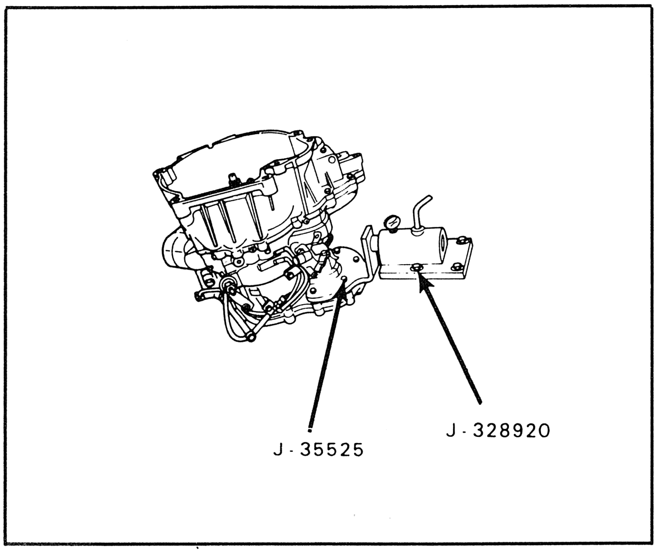


Figure 7A1-71 Holding Fixture J-35525

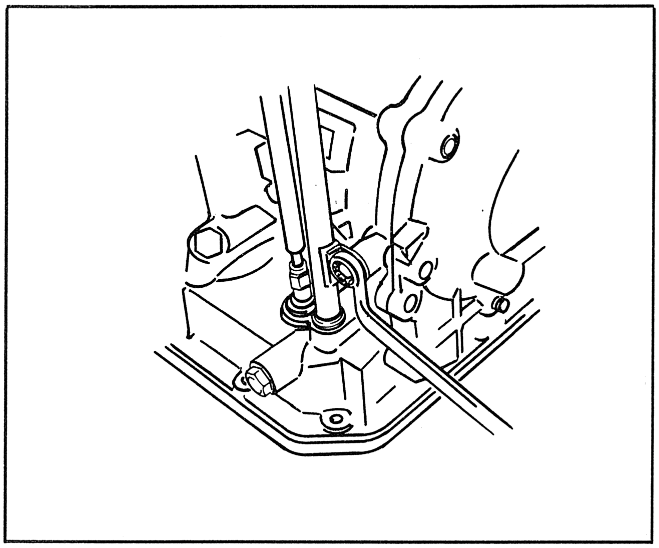
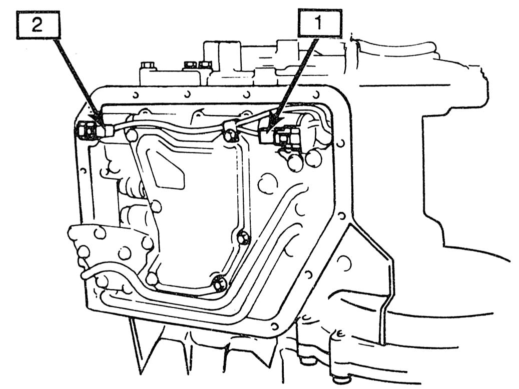


Figure 7A1-72 Removing Oil Filler Tube

NOTICE: For removal of oil pan, do not turn transaxle over as this will contaminate valve body with foreign matters in the bottom of oil pan. When removing oil pan, tap around it lightly with a plastic hammer.

6. Couplers of direct clutch and 2nd brake solenoids.



1 COUPLER OF DIRECT CLUTCH SOLENOID

2 COUPLER OF 2ND BRAKE SOLENOID

Figure 7A1-73 Couplers of Direct Clutch and 2nd Brake Solenoids

7. Two oil tubes from lower valve body.

   Remove them by pulling up the tube end with a screwdriver, see Figure 7A1-74.

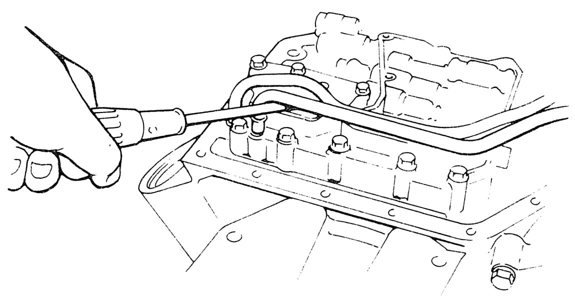
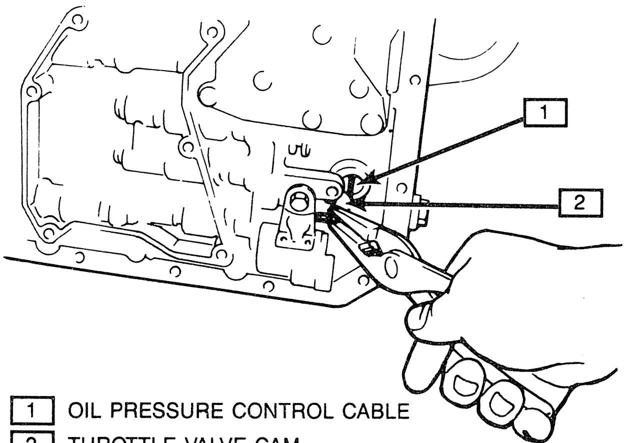


Figure 7A1-74 Removing Oil Tubes

8. Oil pressure control cable from throttle valve cam and then cable.
9. Oil strainer and lower valve body.

   For removal of lower valve body, remove the eleven (11) bolts shown in Figure 7A1-76.
10. Accumulator pistons and spring.

    Position a rag on pistons to catch each piston. To remove pistons, force low-pressure compressed air 15 psi, (100 kPa, max) into holes shown, and pop each piston into the rag.
11. Second brake band cover and gasket.



1 OIL PRESSURE CONTROL CABLE

2 THROTTLE VALVE CAM

Figure 7A1-75 Removing Oil Pressure Control Cable

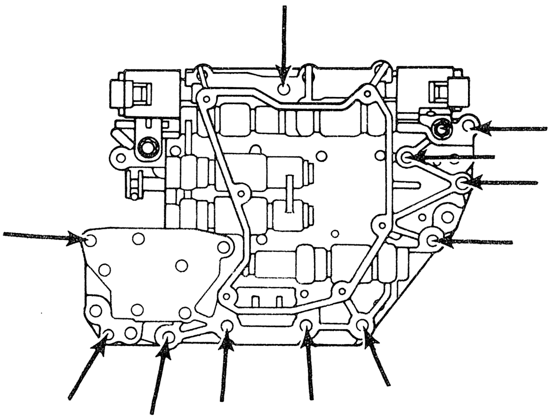
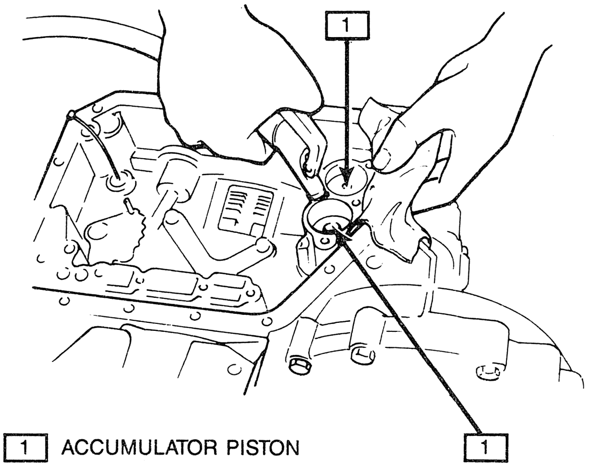


Figure 7A1-76 Lower Valve Body Bolts



1 ACCUMULATOR PISTON

Figure 7A1-77 Removing Accumulator Pistons

12. After removing second brake band cover, check second brake piston stroke as follows.
    a. Scribe mark on piston rod as shown in Figure 7A1-78.
    b. Apply air into oil hole shown in Figure 7A1-77 and measure rod stroke.
    Second Brake Piston Rod Stroke Specification, 1.5-3.0 mm (0.06 - 0.11 in).
    c. If out of specification, replace piston rod with one of a different length or replace second brake band. The 2nd brake piston rod is available in two (2) different lengths (Figure 7A1-78).

Piston rod length	Identification mark
121.3 mm (4.77 in)	Unmarked
122.7 mm (4.83 in)	Marked

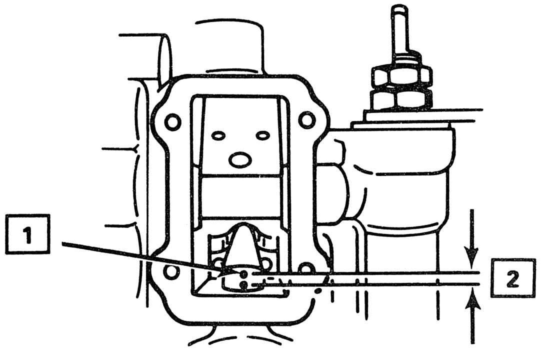
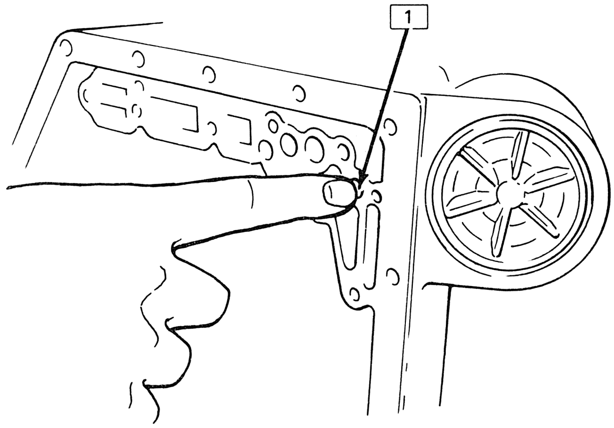


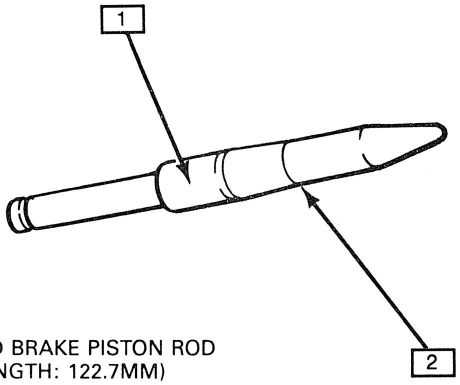
Figure 7A1-78 Mark and Piston Rod Stroke

13. Second brake piston. Install J35534 (Piston Cover Depressor) as shown in Figure 7A1-81. Tighten bolt to compress the piston spring and remove snap ring with a screwdriver.
14. Solenoid wire harness.
    a. Remove wire holding plate retaining nut.
    b. Pull out solenoid wire.
15. Oil pump
    a. Remove six (6) oil pump retaining bolts.
    b. Remove oil pump by using J-6125-B slide hammers with adapters J-35495. Be careful not to drop bearing and bearing races which may sometimes stick to oil pump.
16. Transaxle case housing.
    a. Remove housing internal bolts and external bolts.
    b. Remove housing while tapping around it lightly with a plastic hammer.



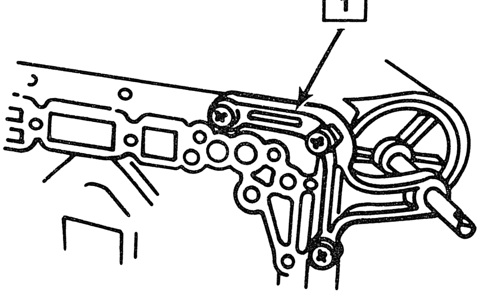
1. OIL HOLE (APPLY AIR HERE)

Figure 7A1-79 Oil Hole



1. 2ND BRAKE PISTON ROD (LENGTH: 122.7MM)
2. IDENTIFICATION MARK

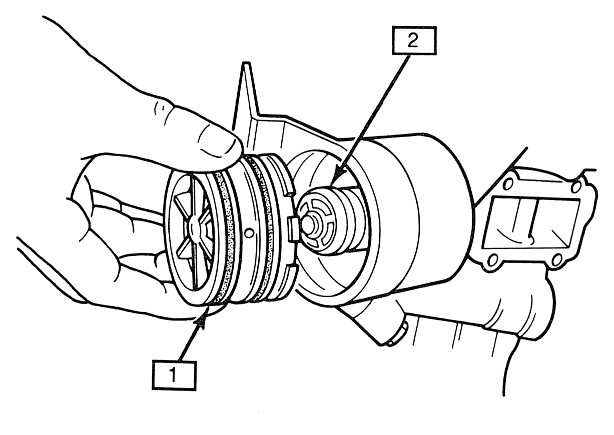
Figure 7A1-80 Mark on Piston Rod



1. J-35534

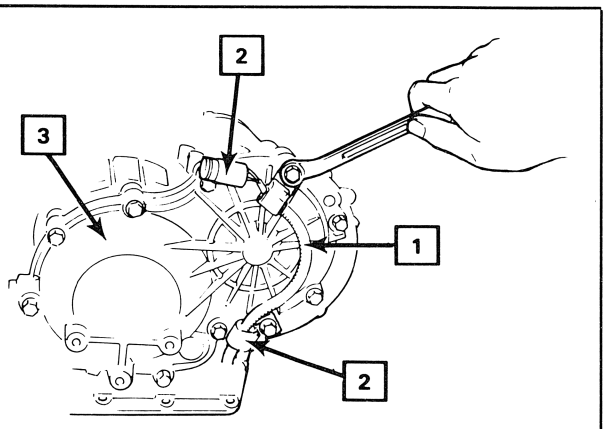
Figure 7A1-81 J35534 Installed

17. Second brake band pin.



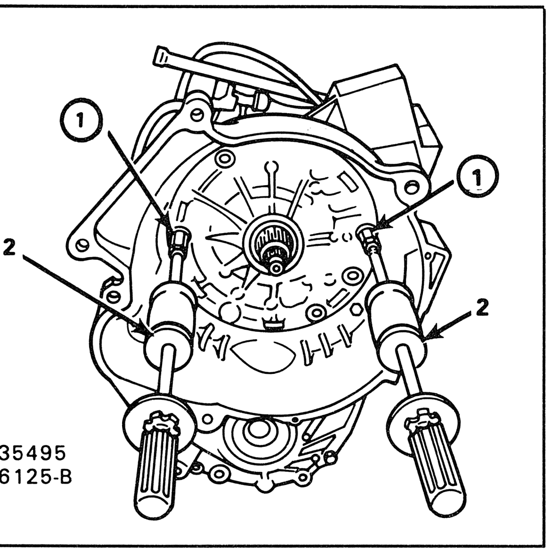
1 PISTON COVER
2 SECOND BRAKE PISTON

Figure 7A1-82 Second Brake Piston



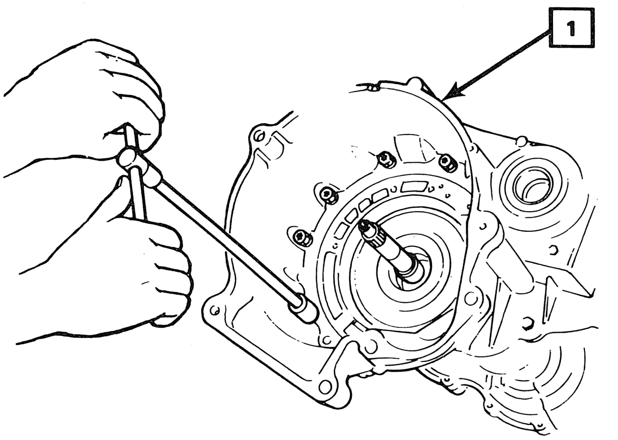
1. SOLENOID WIRE HARNESS
2. CLAMP
3. REAR COVER

Figure 7A1-83 Solenoid Wire Harness



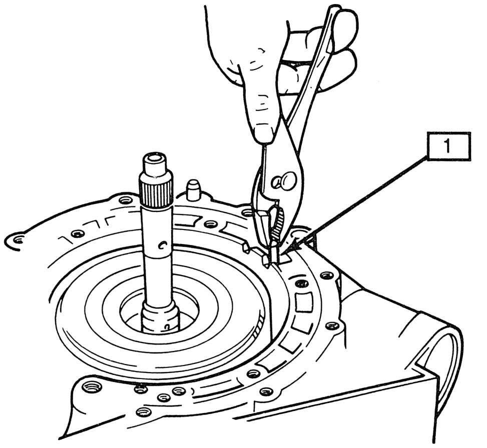
1. J-35495
2. J-6125-B

Figure 7A1-84 Removing Oil Pump



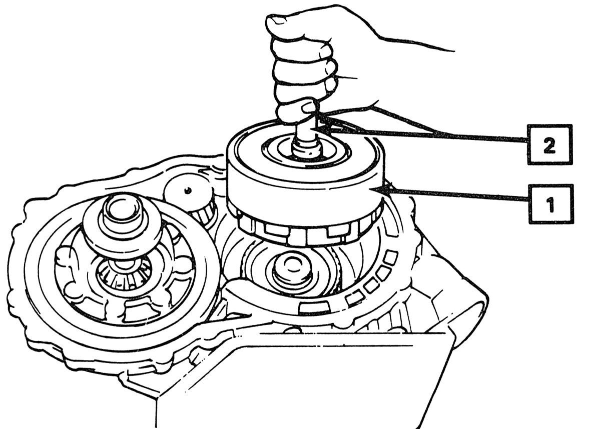
1. TRANSAXLE CASE HOUSING

Figure 7A1-85 Removing Transaxle Case Housing



1 SECOND BRAKE BAND PIN

Figure 7A1-86 Removing Second Brake Band Pin



1. DIRECT CLUTCH
2. INPUT SHAFT

Figure 7A1-87 Removing Direct Clutch and Input Shaft

18. Direct clutch and forward clutch at the same time while holding input shaft. Be careful not to drop the ring gear bearing race and bearing which may sometimes stick to input shaft.

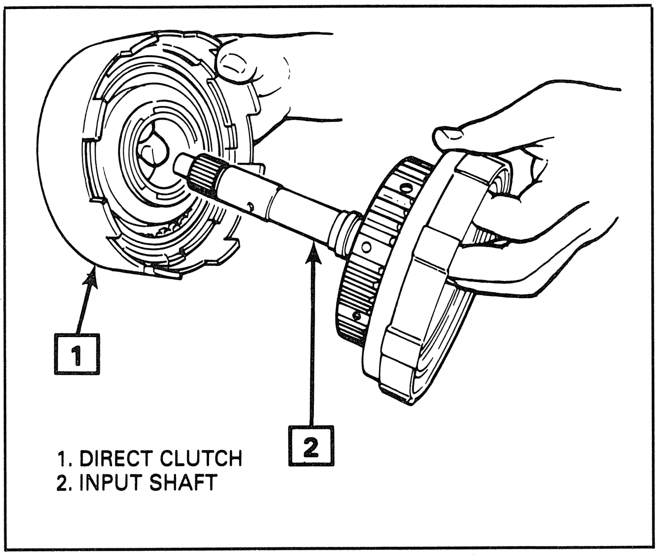


Figure 7A1-88 Removing Direct Clutch

19. Direct clutch assembly from input shaft.
20. Second brake band.
21. Front planetary ring gear and ring gear bearing.

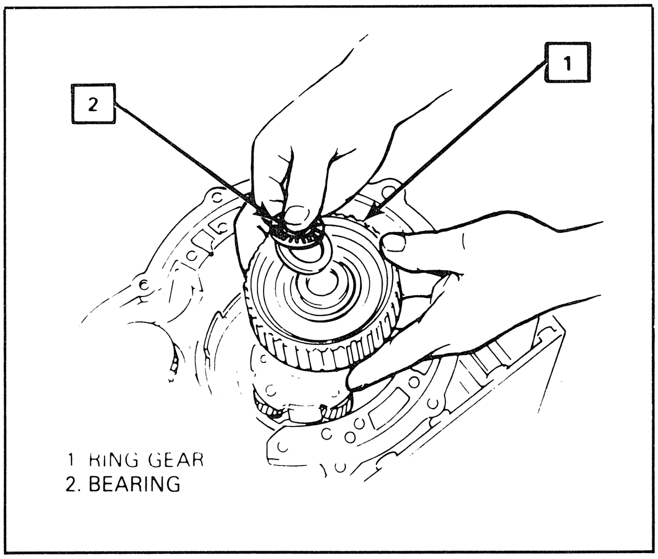


Figure 7A1-89 Removing Front Planetary Ring Gear & Bearing

22. Front planetary gear assembly.
23. Planetary sun gear and front planetary gear bearing.
24. One-way clutch snap ring by using a screwdriver.
    Use care not to damage the transaxle case when removing snap ring.
25. One-way clutch and rear planetary gear.
26. Rear planetary ring gear, ring gear bearing and washers.
27. Check 1st-reverse brake clearance by measuring the clearance between snap ring and flange with a feeler gauge.
    If found out of specification, replace 1st-reverse brake disc or plate with a new one.
28. Two (2) snap rings by using a screwdriver.
29. 1st-reverse brake flange, discs, plates and damper plate.
30. Differential gear assembly.

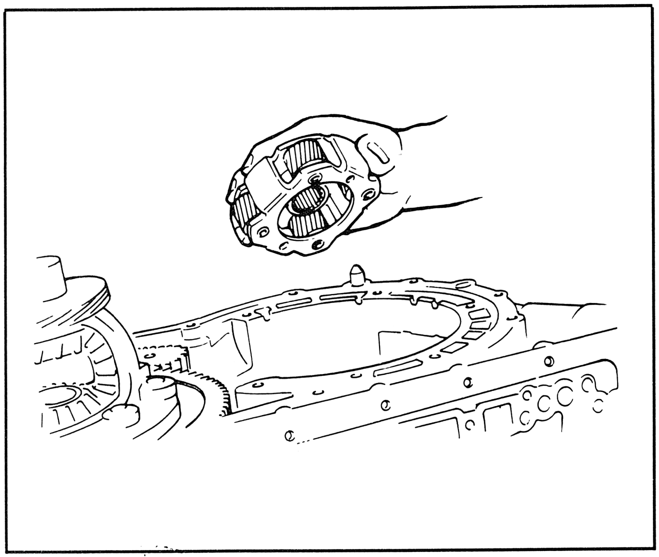


Figure 7A1-90 Front Planetary Gear Assembly

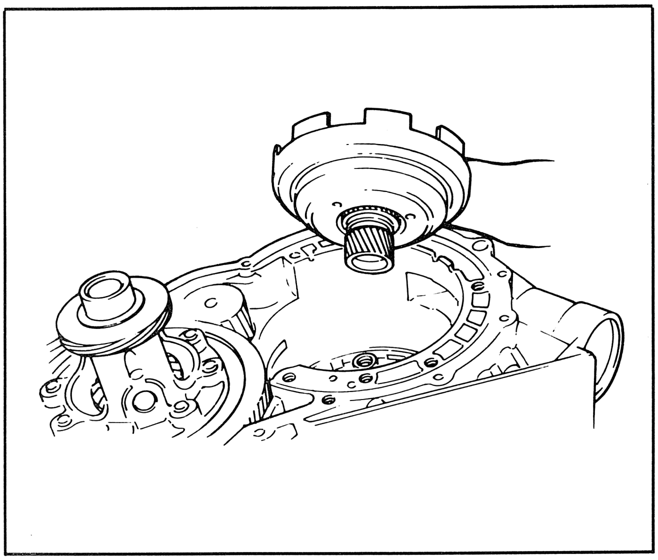


Figure 7A1-91 Planetary Sun Gear

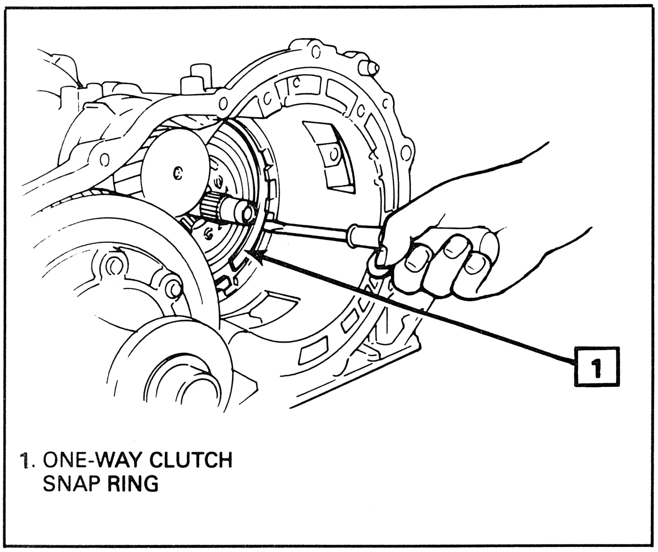


Figure 7A1-92 One-Way Clutch Snap Ring

31. Transaxle rear cover.
    a. Remove ten (10) bolts and two (2) nuts.

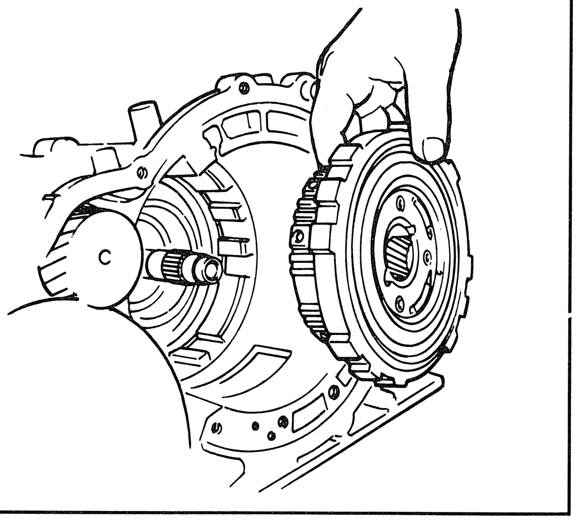


Figure 7A1-93 One-way Clutch and Rear Planetary Gear

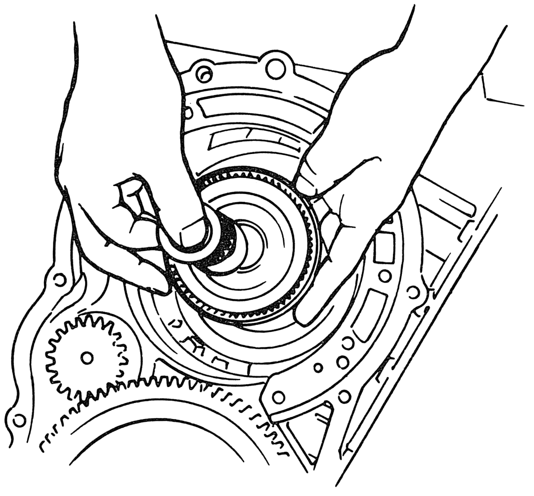
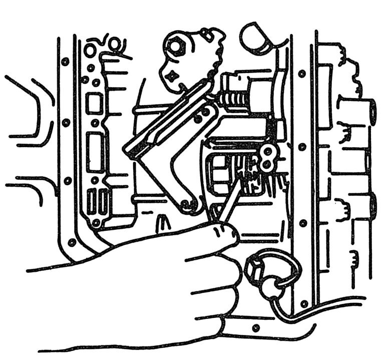


Figure 7A1-94 Rear Planetary Ring Gear, Bearing and Washers



Clearance	0.58 — 1.92mm (0.023 — 0.075 in)

Figure 7A1-95 Checking 1st-Reverse Brake Clearance

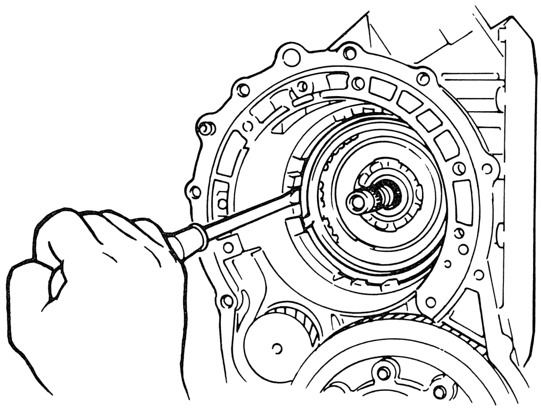


Figure 7A1-96 Removing Two (2) Snap Rings

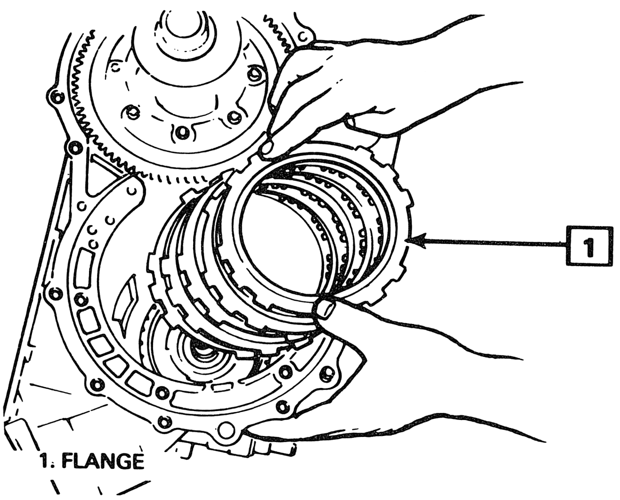


Figure 7A1-97 Removing Flange, Discs and Plates, etc.

b. Remove rear cover by tapping where indicated in Figure 7A1-98 lightly with a plastic hammer.

32. Reduction driven gear nut.
    a. Using a hammer and chisel, remove the stake mark from the retaining nut.
    b. Shift manual shift lever to parking position ("P" range) so that output shaft is locked and cannot turn.
    c. Loosen the reduction driven gear nut.

NOTICE: Loosen the nut carefully using a wrench. Do not use a hammer on the wrench to loosen the retaining nut as parking lock pawl and output shaft may be damaged.

33. Reduction driven gear.
34. Using a plastic hammer, drive the counter shaft out from the case.
35. Output shaft.

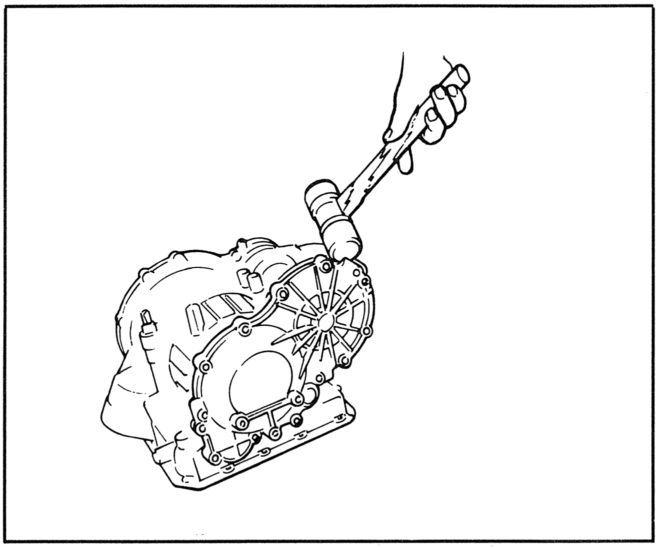
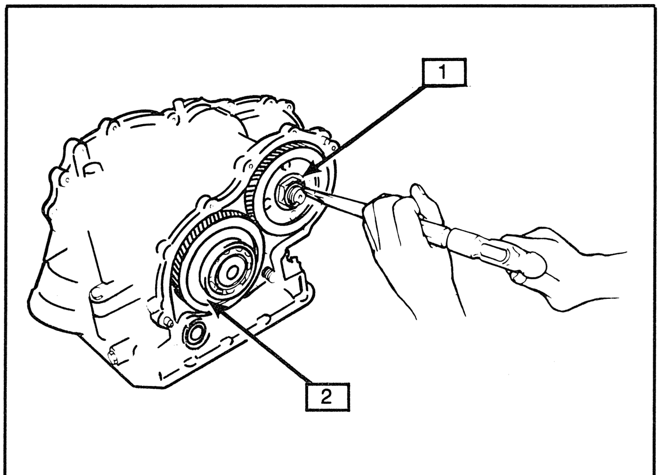


Figure 7A1-98 Removing Rear Cover



1. REDUCTION DRIVEN GEAR NUT
2. OUTPUT SHAFT

Figure 7A1-99 Reduction Driven Gear Nut

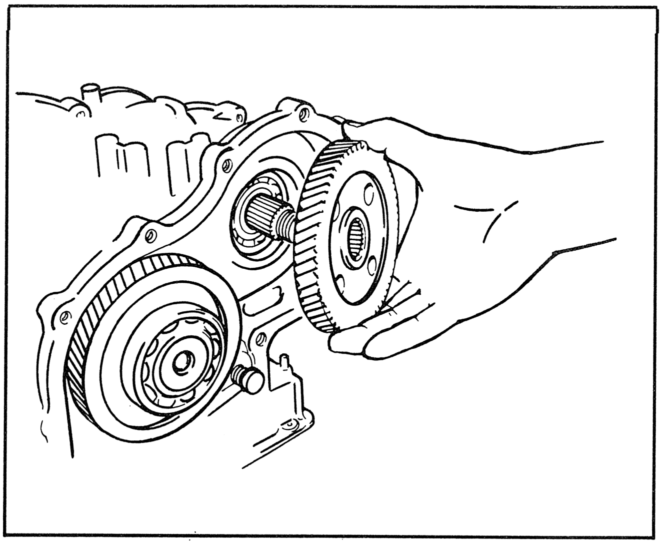


Figure 7A1-100 Removing Reduction Driven Gear

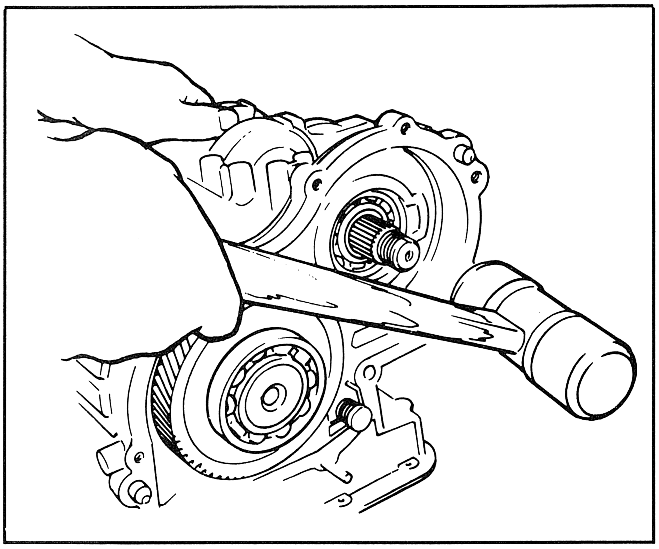
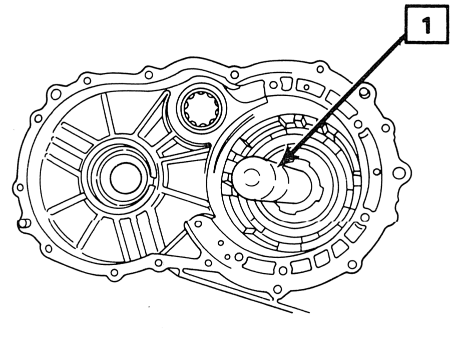


Figure 7A1-101 Removing Counter Shaft

Remove the output shaft by pushing outer race of internal output shaft bearing with J-35539 (Output Shaft Remover) from inside of transaxle case.

NOTICE: Do not tap output shaft itself to drive it out. Output shaft and bearing may be damaged. Be sure to position the four (4) legs of J-35539 (Output Shaft Remover) in four (4) notches of the transaxle case.



1. J-35539

Figure 7A1-102 Removing Output Shaft

36. Parking lock pawl, pawl shaft and sleeve, etc.
    a. Pull out parking lock pawl shaft and spring.
    b. Remove parking lock pawl.
    c. Pull out parking lock pawl sleeve.
    d. Manual detent spring assembly and manual shift shaft.
37. 1st-reverse brake piston.
    a. Push down the return spring assembly and remove the snap ring (Figure 7A1-105).
    b. Remove the return spring assembly (Figure 7A1-106).

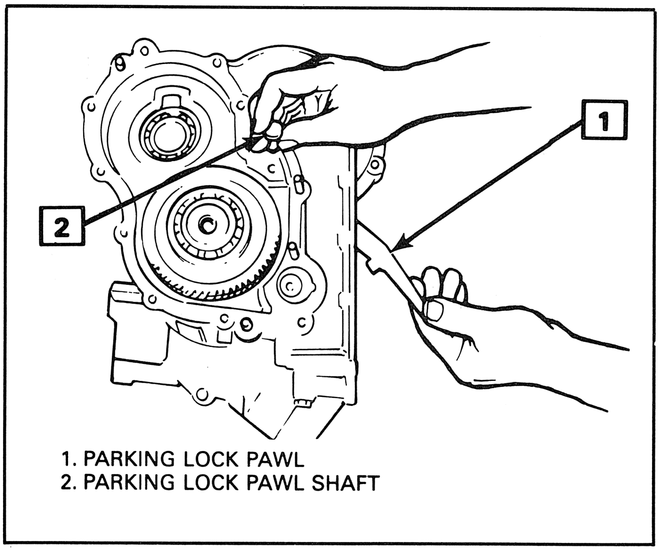

1
2
1. PARKING LOCK PAWL
2. PARKING LOCK PAWL SHAFT

Figure 7A1-103 Removing Parking Lock Pawl Shaft and Parking Lock Pawl

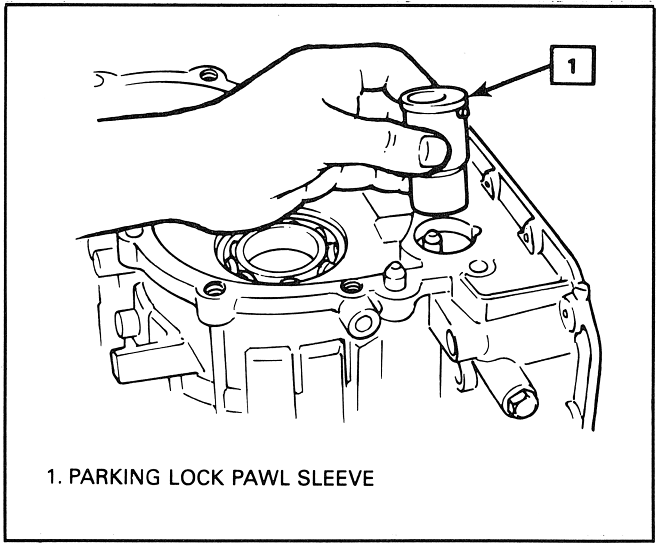

1
1. PARKING LOCK PAWL SLEEVE

Figure 7A1-104 Removing Parking Lock Pawl Sleeve

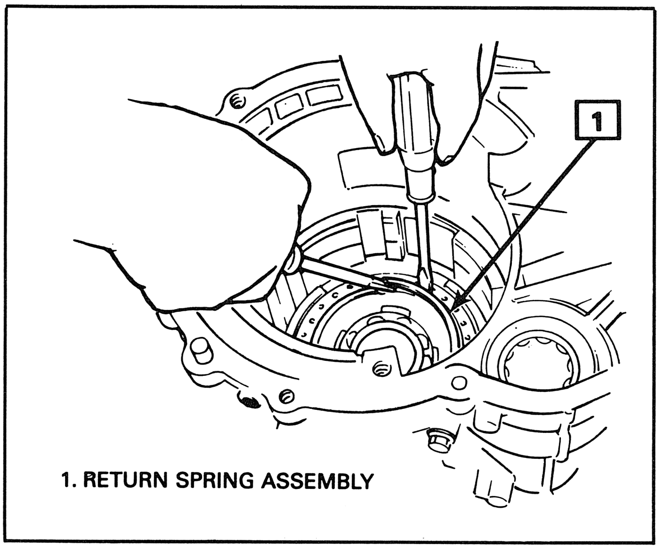

1
1. RETURN SPRING ASSEMBLY

Figure 7A1-105 Removing Snap Ring

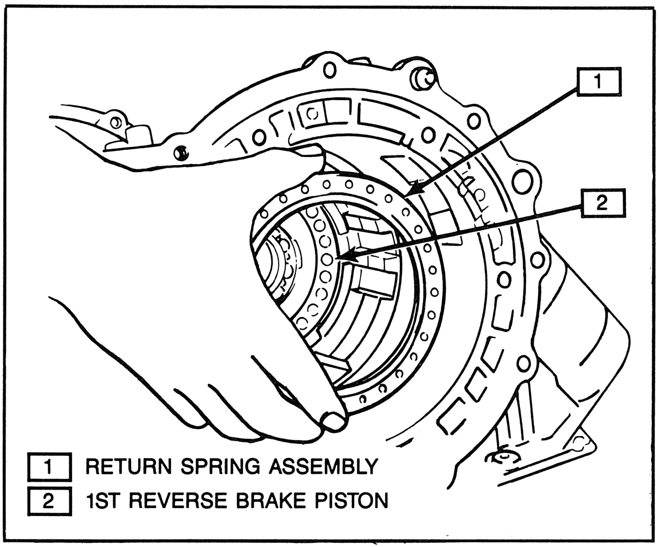

1
2
1 RETURN SPRING ASSEMBLY
2 1ST REVERSE BRAKE PISTON

Figure 7A1-106 Removing Return Spring Assembly

c. Remove 1st-reverse brake piston by applying low-pressure air into oil hole as indicated in Figure 7A1-107.

COMPONENT GROUP OVERHAUL

Figure 7A1-108 shows the component groups. The following procedures describe disassembly, assembly, checking and adjustment procedures of each component group shown.

Disassembly Instructions

Note that parts of the same types are used among some component groups. For example, discs, clutch plates and seals used for different component groups are of the same shapes. If more than two component groups are disassembled at the same time, it may occur that these parts of the same shape but for different component groups are mixed and wrong parts are used for reassembly. Therefore, if it becomes necessary to overhaul more than two component groups, work on one component group at a time. Should it be necessary to overhaul more than two groups at the same time for some reason, make sure to keep parts for each component group separated during disassembly.

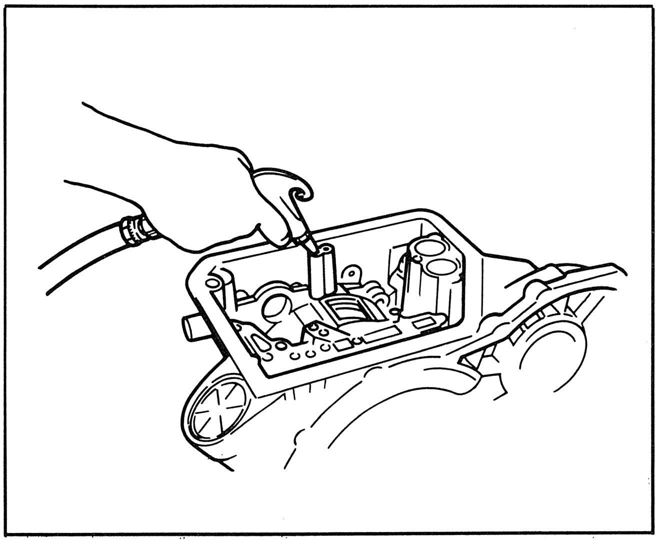


Figure 7A1-107 Removing 1st-Reverse Brake Piston by Applying Air

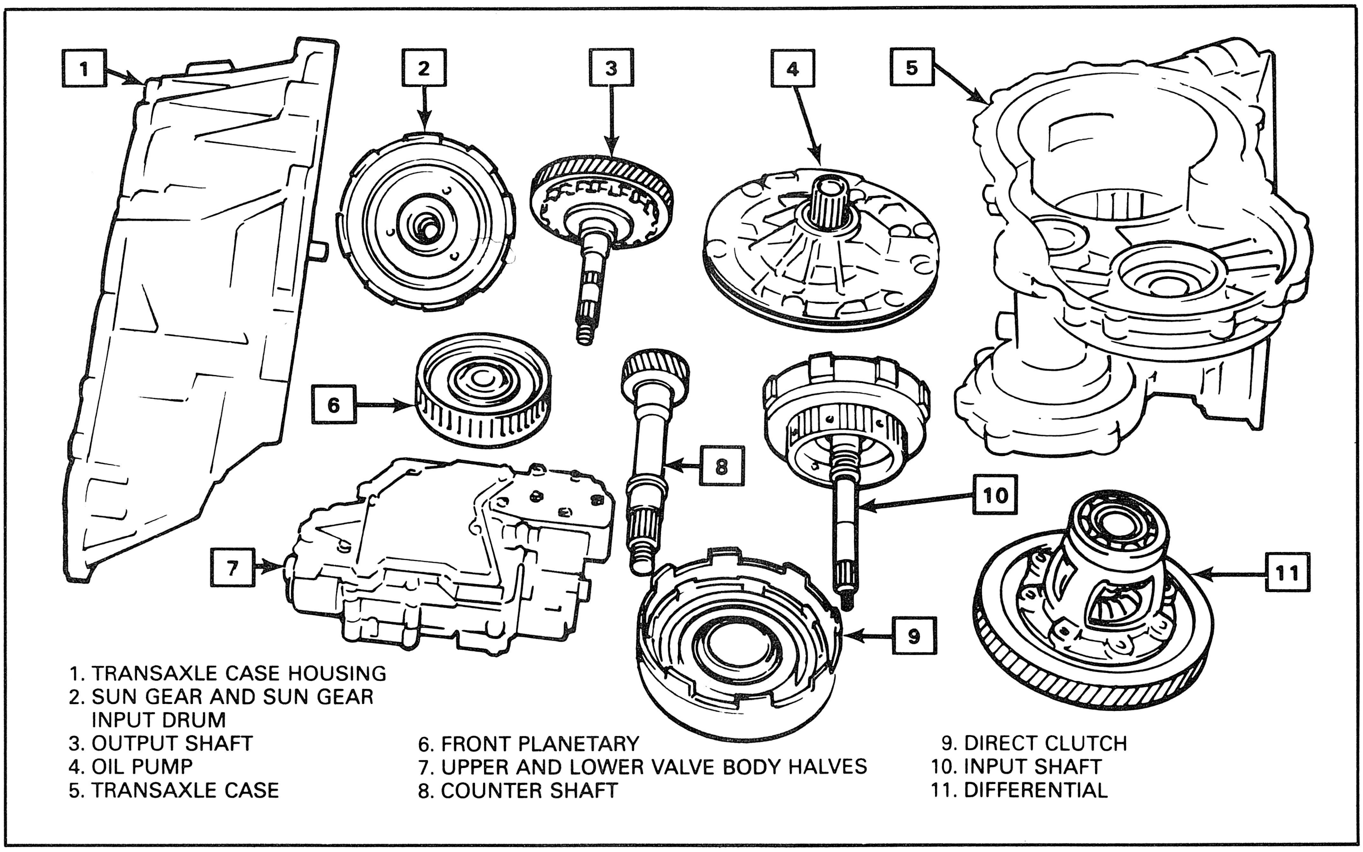


Figure 7A1-108 Component Groups

Cleaning Instructions

1. Before reassembly, be sure to clean all disassembled parts and apply air into fluid passages and holes to clean them.
2. Use automatic transaxle fluid or kerosene as cleaning solvent.

CAUTION: When using compressed air to dry parts, keep your face away to avoid being sprayed with solvent.

Assembly Instructions

1. New brake discs, clutch discs and brake bands that are to be used for replacement must be soaked in automatic transaxle fluid for at least two (2) hours before assembly.
2. Use special care when handling each part component group so as not to damage them.
3. Tighten each bolt and nut to their specified torque.
4. Before installing, be sure to apply automatic transmission fluid to all sliding, rolling and thrusting surfaces of all component parts. Also after installation, make sure to check each part for proper operation.
5. After each gear installation, check to make sure that gear rotates smoothly.
6. When handling bearings, use care to prevent damage to bearings. Apply Automatic Transmission Fluid to all bearings before installation.
7. All gaskets and rubber "O" rings should be replaced.
8. Make sure that snap ring ends are not lined with one of cutouts and are installed in groove correctly.
9. Check thrust bearings and races for wear or damage.
10. When installing bearings, do not apply force to ball or roller. When installing bearing, do not apply excessive force.
11. Be sure to make proper selection of direct and forward clutch flanges, input shaft bearing race and 2nd brake rod and to adjust each to specification.
12. When installing seal ring, be careful so that it is not expanded excessively, extruded or caught.
13. Apply Automatic Transmission Fluid to all "O" ring.

OIL PUMP

Remove or Disconnect

1. Two (2) oil pump cover seal rings.
2. Oil pump cover seal ("O" ring).
3. Eleven (11) bolts.
4. Oil pump cover.

Inspect

1. Pump body oil seal. Check for wear, damage or cracks. Replace oil seal if necessary.
2. Body clearance of driven gear. Push driven gear to one side of body. Using a feeler gauge, measure clearance between driven gear and body. If the clearance exceeds the limit, replace driven gear.

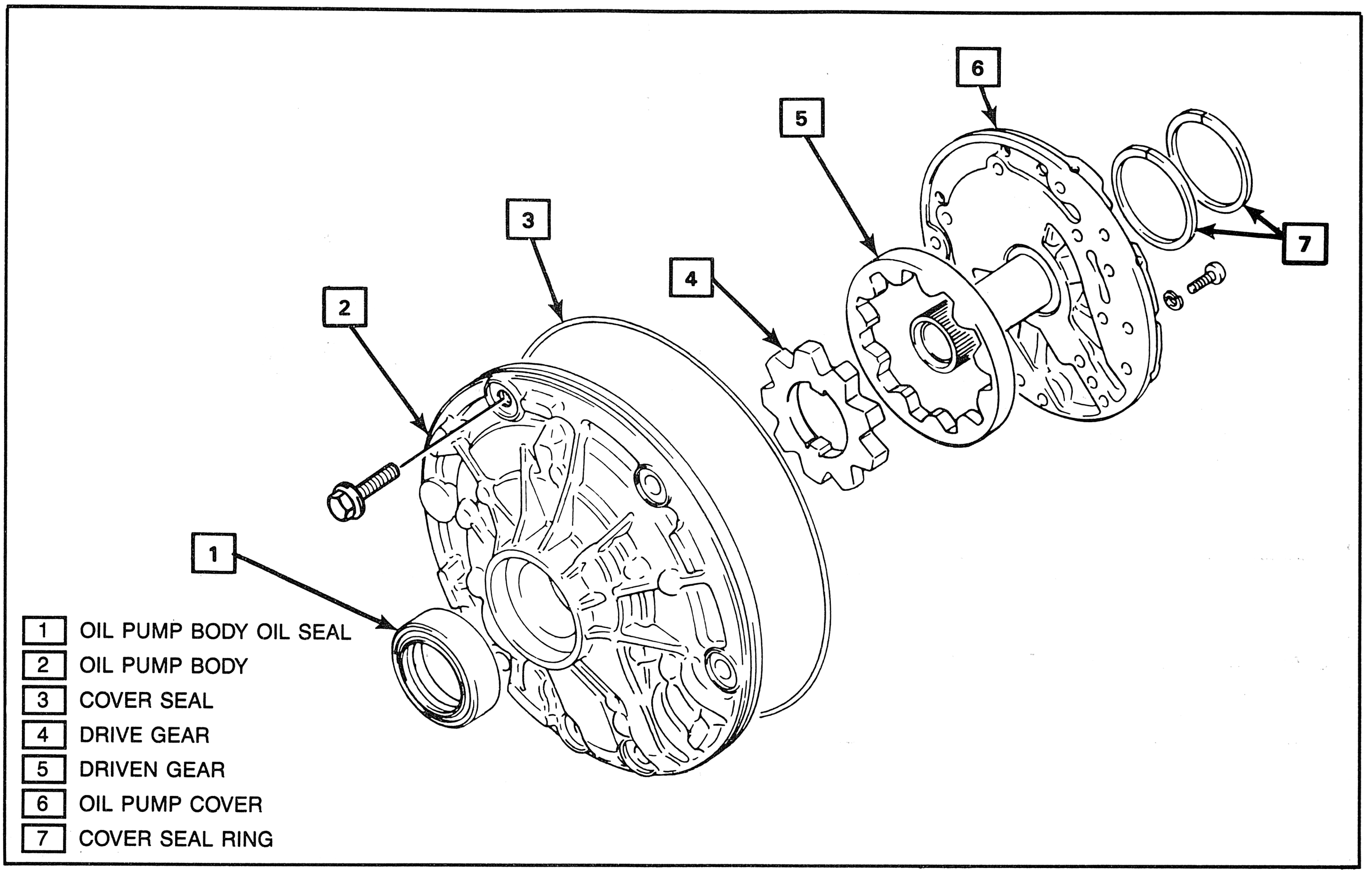

6
5
3
4
7
2
1
1 OIL PUMP BODY OIL SEAL
2 OIL PUMP BODY
3 COVER SEAL
4 DRIVE GEAR
5 DRIVEN GEAR
6 OIL PUMP COVER
7 COVER SEAL RING

Figure 7A1-109 Exploded View of Oil Pump

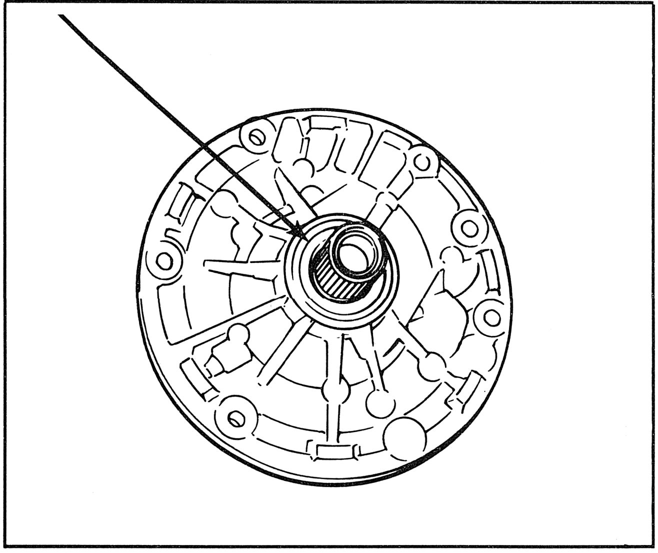


Figure 7A1-110 Pump Body Oil Seal

STANDARD BODY CLEARANCE	0.07-0.15 mm (0.0028-0.0059 IN.)
LIMIT	0.30 mm (0.011 IN.)

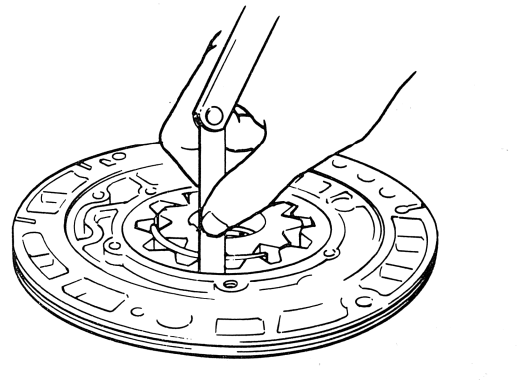


Figure 7A1-111 Checking Body Clearance

3. Tip clearance of both drive and driven gears. Measure (radial) clearance between gear teeth and crescent. If the clearance exceeds the limit, replace the gear.

4. Side clearance of both gears. Using a steel straightedge (J-34673) and a feeler gauge, measure the side clearance between drive/driven gear and pump body.

Install or Connect

1. Driven gear and drive gear in pump body. Before installing, apply Automatic Transmission Fluid to gears.
2. Pump cover to pump body. Install elecen (11) pump cover bolts and tighten to specification.
3. Two (2) oil pump cover seal rings.
4. Apply Automatic Transmission Fluid to oil pump bushing and two (2) seal rings.
5. Oil pump cover seal (O ring). Make sure that seal is not twisted and is fully seated in groove.

STANDARD TIP CLEARANCE	0.11-0.14 mm (0.0044-0.0055 IN.)
LIMIT	0.30 mm (0.011 IN.)

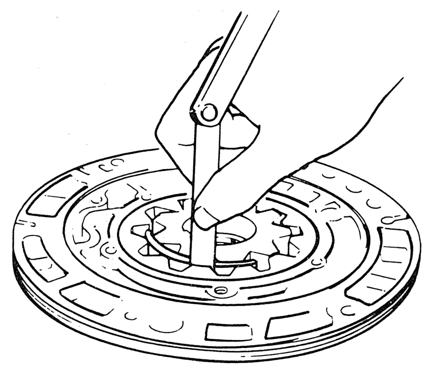


Figure 7A1-112 Checking Tip Clearance

STANDARD SIDE CLEARANCE	0.02-0.05 MM (0.0008-0.0019 IN.)
LIMIT	0.1 MM (0.0039 IN.)

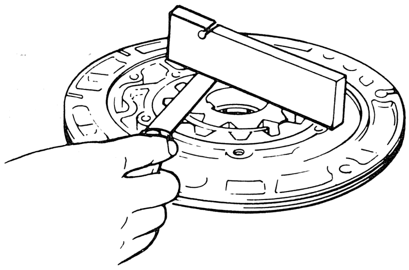
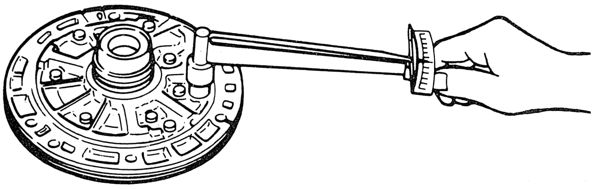


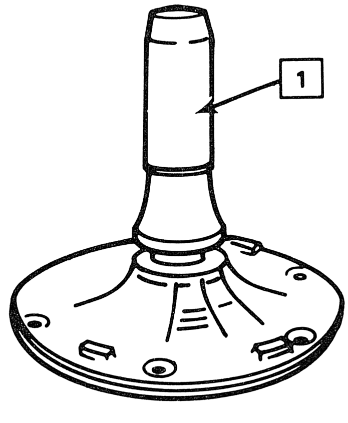
Figure 7A1-113 Checking Side Clearance



TORQUE TO:
8-12 N·m
6-8.5 LB. FT.

Figure 7A1-114 Tightening Pump Cover Bolts

6. Check drive gear for smooth rotation.



1 J-9617

Figure 7A1-115 Using J9617

7. Install the pump body oil seal using J9617 (Figure 7A1-115).

DIRECT CLUTCH

Preliminary Check

Check direct clutch clearance before disassembly. To check the clearance, measure the height between snap ring and clutch flange by using a Vernier as shown in Figure 7A1-117. If the height is within the specification, it means that the clutch clearance is within the specification. If the height is out of specification, replace clutch discs or plate with new ones.

Remove or Disconnect

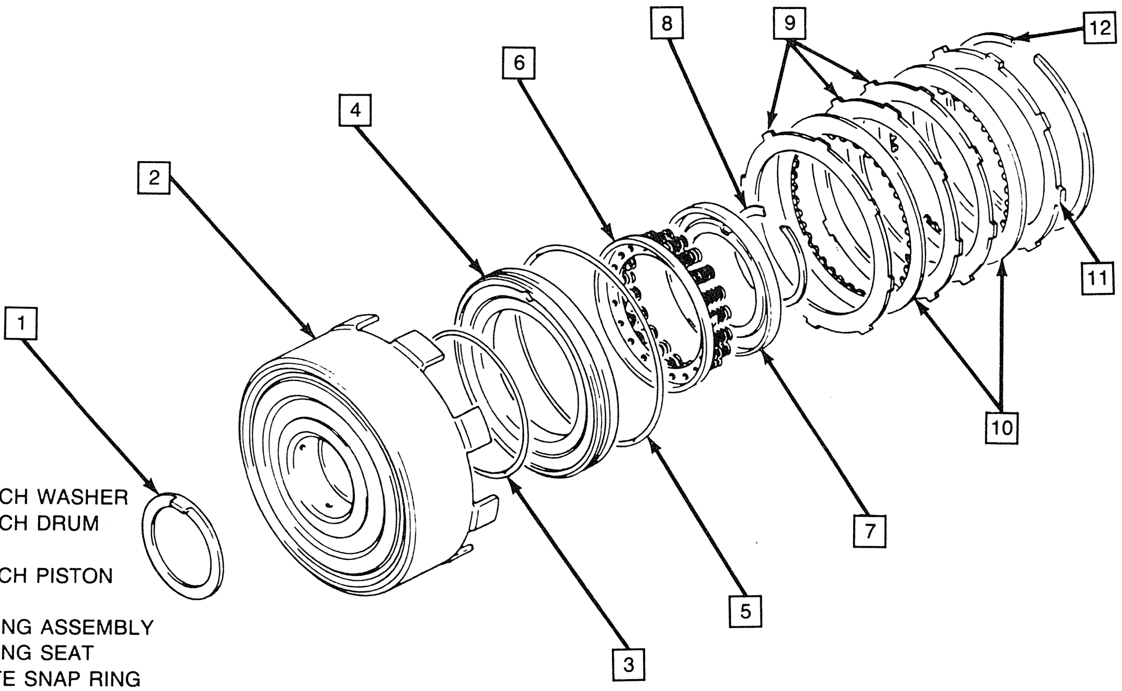
1. Clutch plate snap ring.
2. Clutch flange, discs and plates.
3. Clutch plate snap ring. Compress piston return springs and remove snap ring. Place J-23327 (Clutch Spring Compressor) on the return spring seat and compress springs with a press. Then using a screwdriver, remove snap ring.
4. Spring seat and return spring assembly.
5. Direct clutch piston. Apply compressed air through drum oil hole to remove piston. If piston does not pop out, lift out the piston with needle nose pliers.
6. Inner seal from drum.
7. Outer seal from piston.

Inspect

1. Check valve (steel ball) for free movement in piston.
2. Check valve for leakage by using low pressure air. If found faulty, replace the piston.

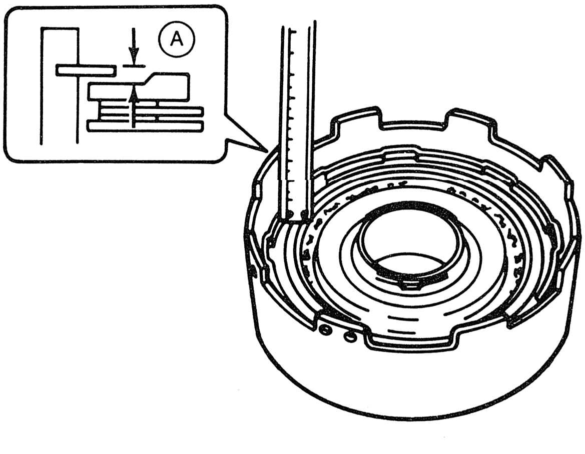
Install or Connect

1. New inner seal ("O" ring). Apply Automatic Transmission Fluid to the inner seal and fit it in the drum.



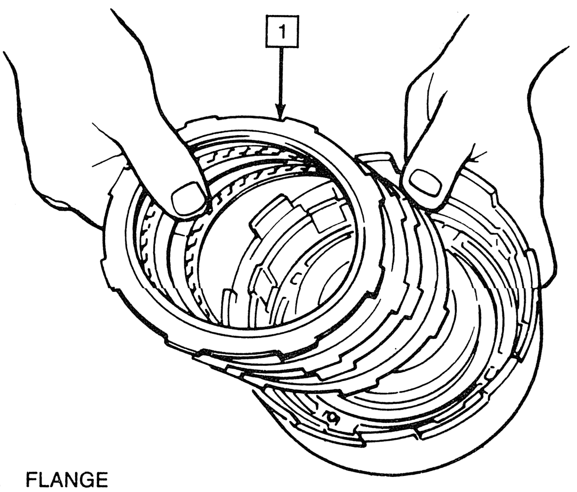
1. DIRECT CLUTCH WASHER
2. DIRECT CLUTCH DRUM
3. INNER SEAL
4. DIRECT CLUTCH PISTON
5. OUTER SEAL
6. RETURN SPRING ASSEMBLY
7. RETURN SPRING SEAT
8. CLUTCH PLATE SNAP RING
9. CLUTCH PLATE
10. CLUTCH DISC
11. CLUTCH FLANGE
12. CLUTCH PLATE SNAP RING

Figure 7A1-116 Exploded View of Direct Clutch



Height between snap ring and clutch flange Ⓐ	2.49 — 3.06mm (0.098 — 0.120 in)

Figure 7A1-117 Measuring Direct Clutch Clearance



1. FLANGE

Figure 7A1-118 Removing Flange, Discs and Plates

2. New outer seal (“O” ring). Apply Automatic Transmission Fluid to the outer seal and fit it to the piston.
3. Piston into drum. Be careful so that seals (“O” ring) do not get twisted or caught.
4. Clutch return spring assembly.
5. Spring seat.
6. Snap ring. Compress return springs and install spring seat snap ring in groove. Place J-23327 and J-25018-A (Clutch Spring Compressor and Adapter) on spring seat and compress springs

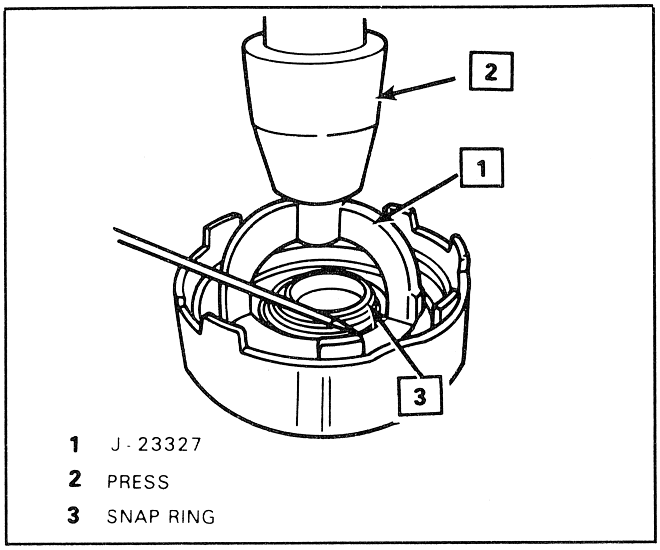

2
1
3
1 J-23327
2 PRESS
3 SNAP RING

Figure 7A1-119 Removing Snap Ring

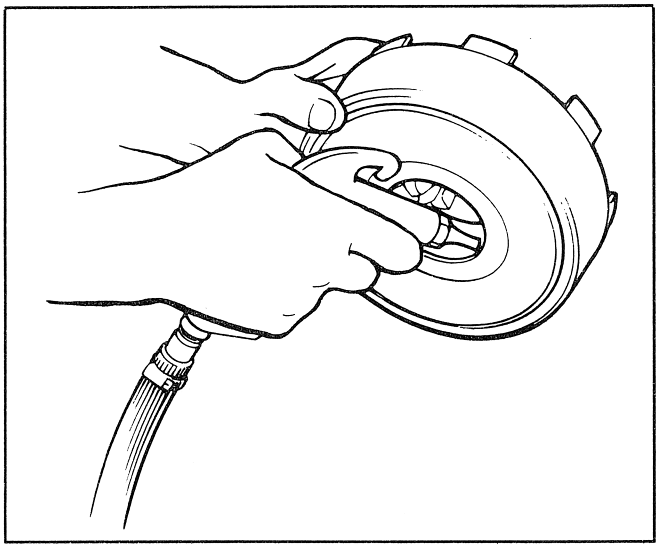


Figure 7A1-120 Removing Direct Clutch Piston

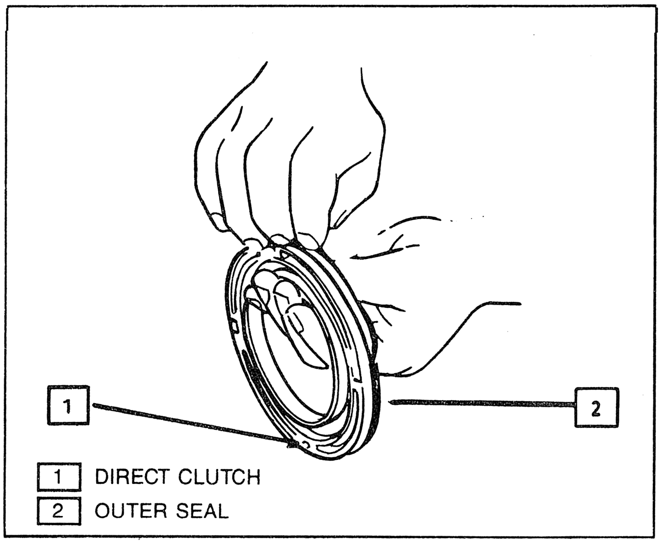

1
2
1 DIRECT CLUTCH
2 OUTER SEAL

Figure 7A1-121 Removing Outer Seal

with press. Then, install snap ring using a screwdriver (Figure 7A1-119).

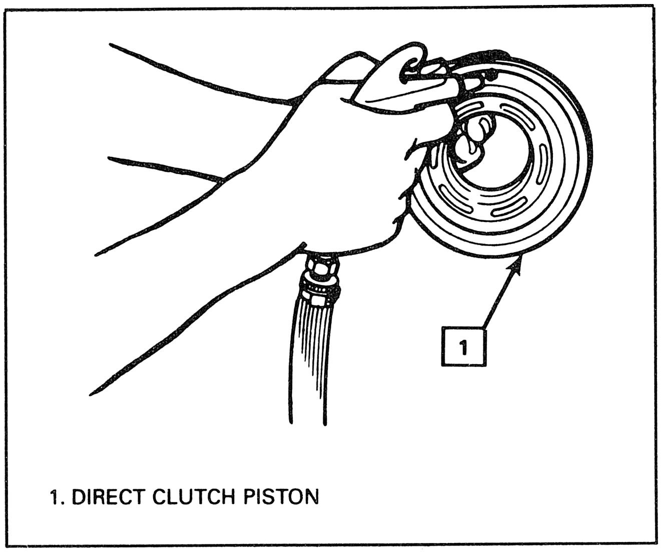

1
1. DIRECT CLUTCH PISTON

Figure 7A1-122 Checking Check Ball Leakage

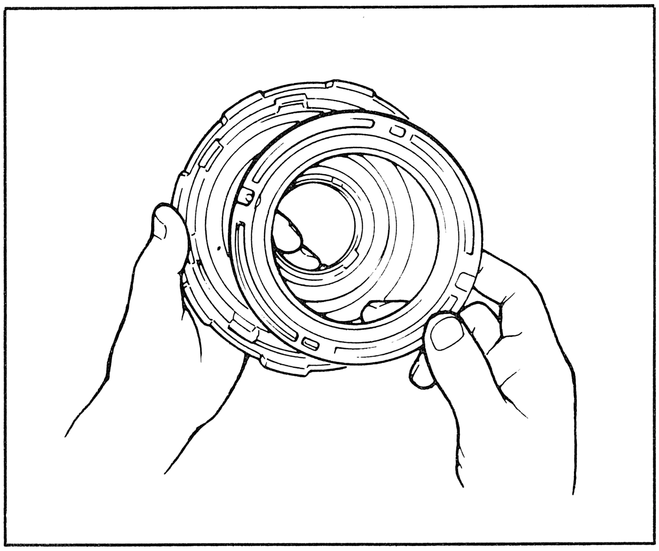


Figure 7A1-123 Installing Piston to Drum

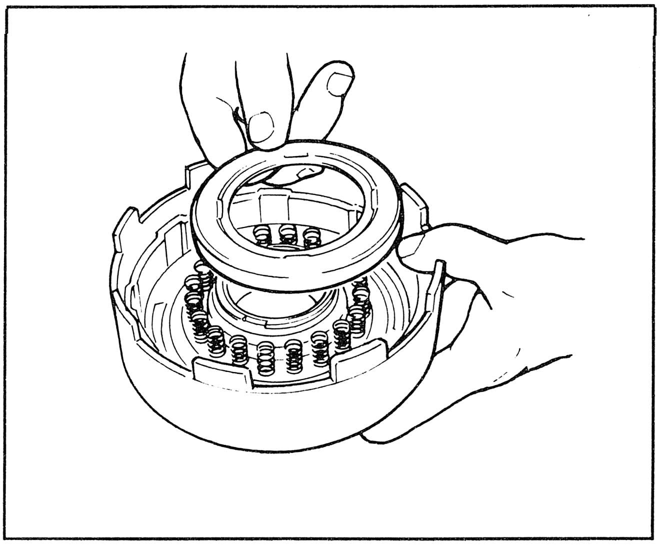


Figure 7A1-124 Installing Spring Seat

NOTICE: Check to make sure that snap ring is securely fitted in four (4) projections of spring seat. Do not compress return spring more than necessary.

7. Discs, plates and flange. Install the following in that order.
   a. Plate
   b. Clutch disc
   c. Plate
   d. Plate
   e. Clutch disc
   f. Flange

NOTICE: If new clutch discs are to be installed, they must be soaked in automatic transmission fluid for at least two (2) hours before assembly.

8. Clutch plate snap ring.
9. After installing clutch plate snap ring, measure the height between snap ring and clutch flange as previously outlined. See Figure 7A1-117.

If out of specification even when new clutch discs and plates are installed, install a flange of a different thickness. Following two (2) sizes of clutch flanges are available.

- Thickness 3.00mm (0.118 in.)
- Thickness 3.37mm (0.132 in.)

10. Check piston for movement by applying air through oil hole in drum.

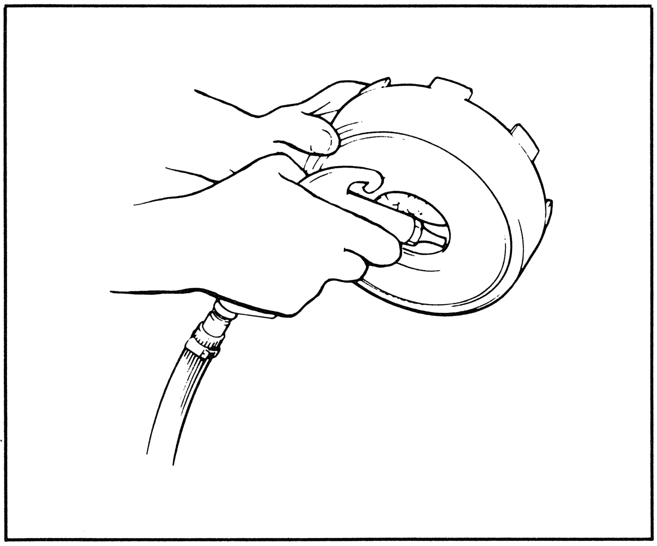


Figure 7A1-125 Checking Piston for Movement

FORWARD CLUTCH

Preliminary Check

Check forward clutch clearance before disassembly. To check the clearance, measure the height between the snap ring and clutch flange by using A Vernier as shown in Figure 7A1-127. If the height is within the specification, it means that the clutch clearance is within specification. If the height is out of specification, replace clutch discs or plates with new ones.

Remove or Disconnect

1. Clutch plate snap ring.
2. Flange, discs and plates.
3. Spring seat snap ring. Compress piston return springs and remove snap ring. Place J-23327 and J-25018-A (Clutch Spring Compressor and Adapter) on the spring seat and compress spring with a press, and then, remove snap ring using a screwdriver. Do not push down return spring more than necessary.
4. Spring seat and springs.
5. Forward clutch piston. Apply compressed air through input shaft oil hole to remove piston. If piston does not pop out, lift it out with needle nose pliers.
6. Inner and outer seals ("O" rings) from piston.

Inspect

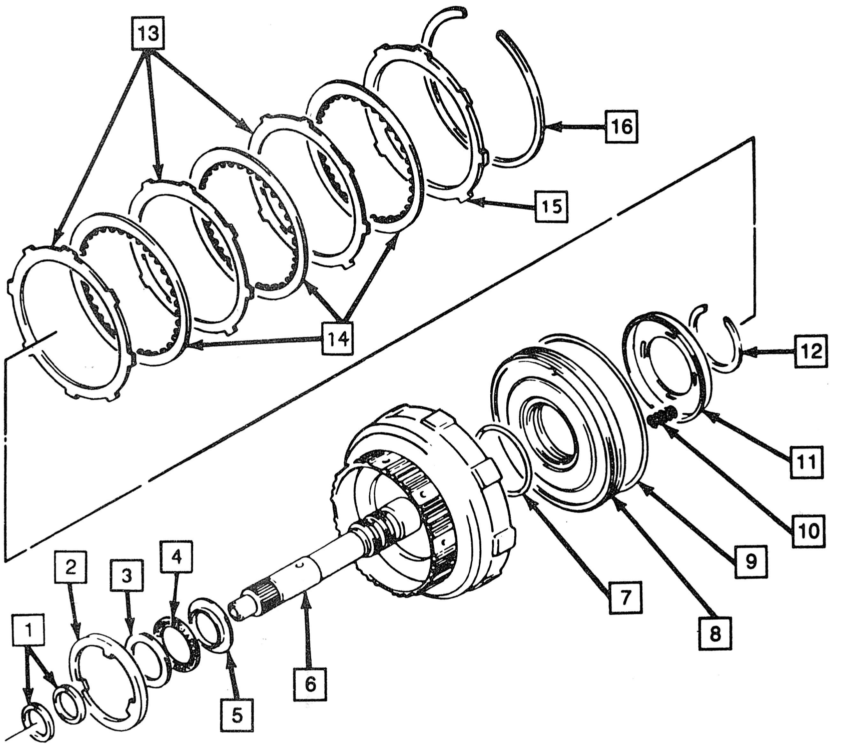
1. Check valve (ball) for free movement in clutch piston.
2. Check valve for leakage by using low pressure air. If found faulty, replace clutch piston.

Install or Connect

1. New inner and outer seals ("O" rings) to clutch piston. Apply Automatic Transmission Fluid to seals and fit to piston.
2. Piston into input shaft drum. Use care so that seals do not get twisted or caught.
3. Eighteen (18) piston return springs and spring seat.
4. Spring seat snap ring. Compress return springs and install snap rings in groove by using a screwdriver. Place J-23327 and J-25018-A (Clutch Spring Compressor and Adapter) on spring seat and compress springs with a press (Figure 7A1-129).

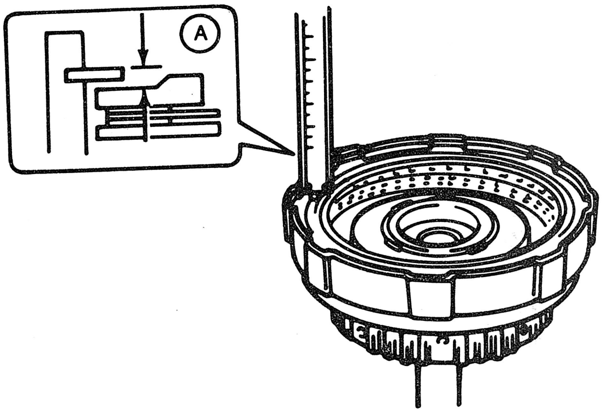
NOTICE: Check to make sure that snap ring is securely fitted in four (4) projections of spring seat. Do not compress return spring more than necessary.

5. Install discs, plates and flange. Install them in following order.
   a. Plate
   b. Clutch disc
   c. Plate
   d. Clutch disc
   e. Plate
   f. Clutch disc
   g. Flange
6. Clutch plate snap ring.
7. After installing clutch plate snap ring, measure the height between snap ring and clutch flange as previously outlined. See Figure 7A1-127 for checking forward clutch clearance. If discs and plates are new and yet out of specification, install flange of different thickness. The following two (2) sizes of clutch flanges are available.
   - Thickness 3.00mm (0.118 in.)
   - Thickness 3.37mm (0.132 in.)



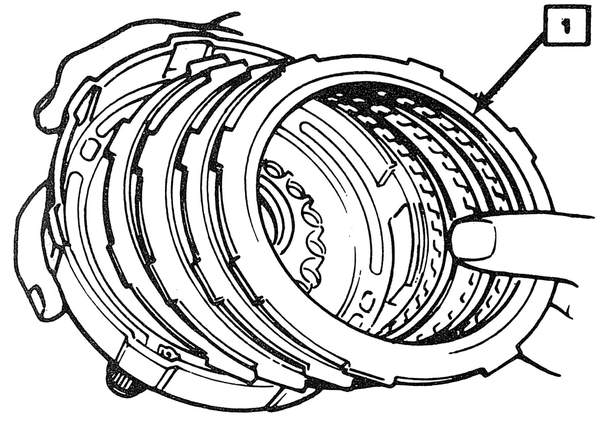
1. INPUT SHAFT SEAL RING
2. DIRECT CLUTCH WASHER
3. INPUT SHAFT BEARING RACE
4. INPUT SHAFT BEARING
5. BEARING RACE
6. INPUT SHAFT
7. INNER SEAL
8. FORWARD CLUTCH PISTON
9. OUTER SEAL
10. RETURN SPRING
11. RETURN SPRING SEAT
12. SPRING SEAT SNAP RING
13. CLUTCH PLATE
14. CLUTCH DISC
15. CLUTCH FLANGE
16. CLUTCH PLATE SNAP RING

Figure 7A1-126 Exploded View of Forward Clutch



Height between snap ring and clutch flange (A)	2.01 — 2.68mm (0.079 — 0.105 in)

Figure 7A1-127 Checking Forward Clutch Clearance



1 FLANGE

Figure 7A1-128 Removing Flange, Discs and Plates

8. Check clutch piston for movement by applying air through input shaft oil hole.

UPPER AND LOWER VALVE BODY HALVES

Important Steps in Disassembly and Reassembly of Valve Bodies

1. When disassembling valve body, be sure to keep each valve together with its corresponding spring.
2. When removing upper valve body from lower one, be careful not to drop four (4) steel check balls shown in Figure 7A1-134. When assembling, install these four (4) steel balls at the

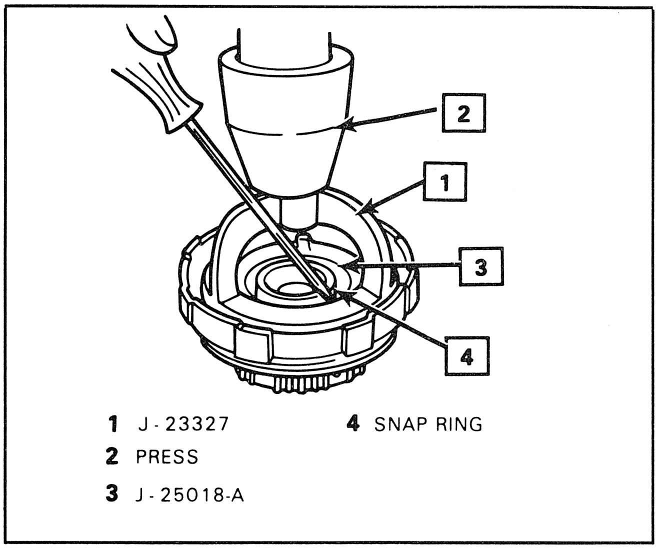


Figure 7A1-129 Removing Spring Seat Snap Ring

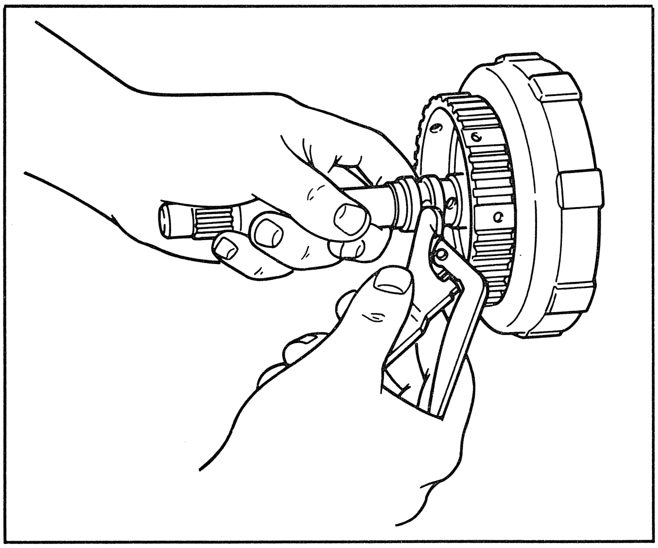


Figure 7A1-130 Removing Clutch Piston

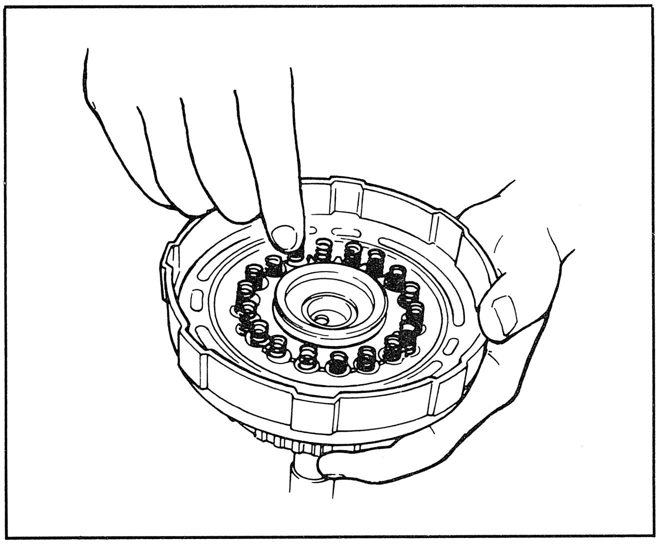


Figure 7A1-131 Installing Piston Return Springs

positions in upper valve body as shown in Figure 7A1-134.

3. Replace each gasket with a new one. Make sure that the new gasket is the same as the old one before installation.
4. When installing each valve in the valve body, use special care for proper installing direction.
5. Several throttle valve rings are used at the throttle valve in the upper valve body. Be sure to install the same number of throttle valve rings as those used before disassembly. See Figure 7A1-132 for the throttle valve ring.
6. When installing lower valve body cover and gasket to lower valve body, tighten the lower valve body bolts to specification.
   - 4-6 N·m (3-4 ft. lbs.)
7. Tighten throttle valve cam bolt to specification.
   - 6-9 N·m (4.5-6.5 ft. lbs.)
8. When installing upper valve body to lower one, install sixteen (16) upper valve body bolts as follows.
   a. Install two (2) reamer bolts (positioning bolts) at the positions shown as "D" in Figure 7A1-135. Do not tighten these bolts to specification at this time. Finger-tight only.
   b. Install other fourteen (14) bolts as shown in Figure 7A1-135.
   c. Tighten four (4) bolts, shown as 2, to specification.
   d. Tighten eight (8) bolts, shown as 3, to specification.
   e. Tighten two (2) bolts, shown as 4, and two (2) reamer bolts, shown as 1, to specification.

COUNTER SHAFT AND OUTPUT SHAFT BEARINGS

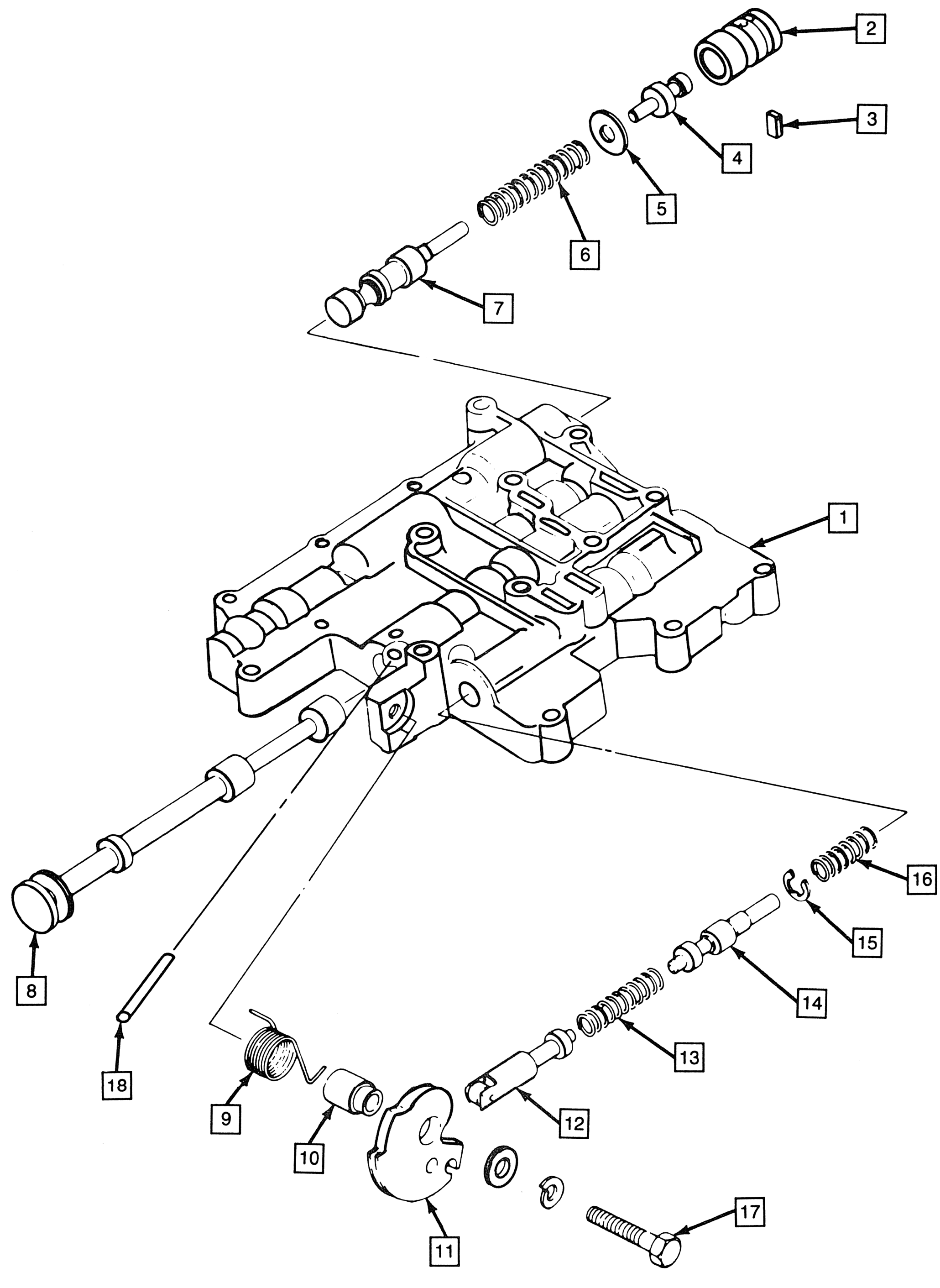
COUNTER SHAFT BEARINGS

Remove or Disconnect

1. Snap rings by using a screwdriver.
2. Backing plate (rear cover side).
3. Front and rear counter shaft bearings.
   a. Using J-29369-1 and J-23907 (Bearing Remover and Slide Hammer), remove the countershaft ball bearing.
   b. Using J-29369-2 and J-23907 (Bearing Remover and Slide Hammer), remove the countershaft roller bearing.

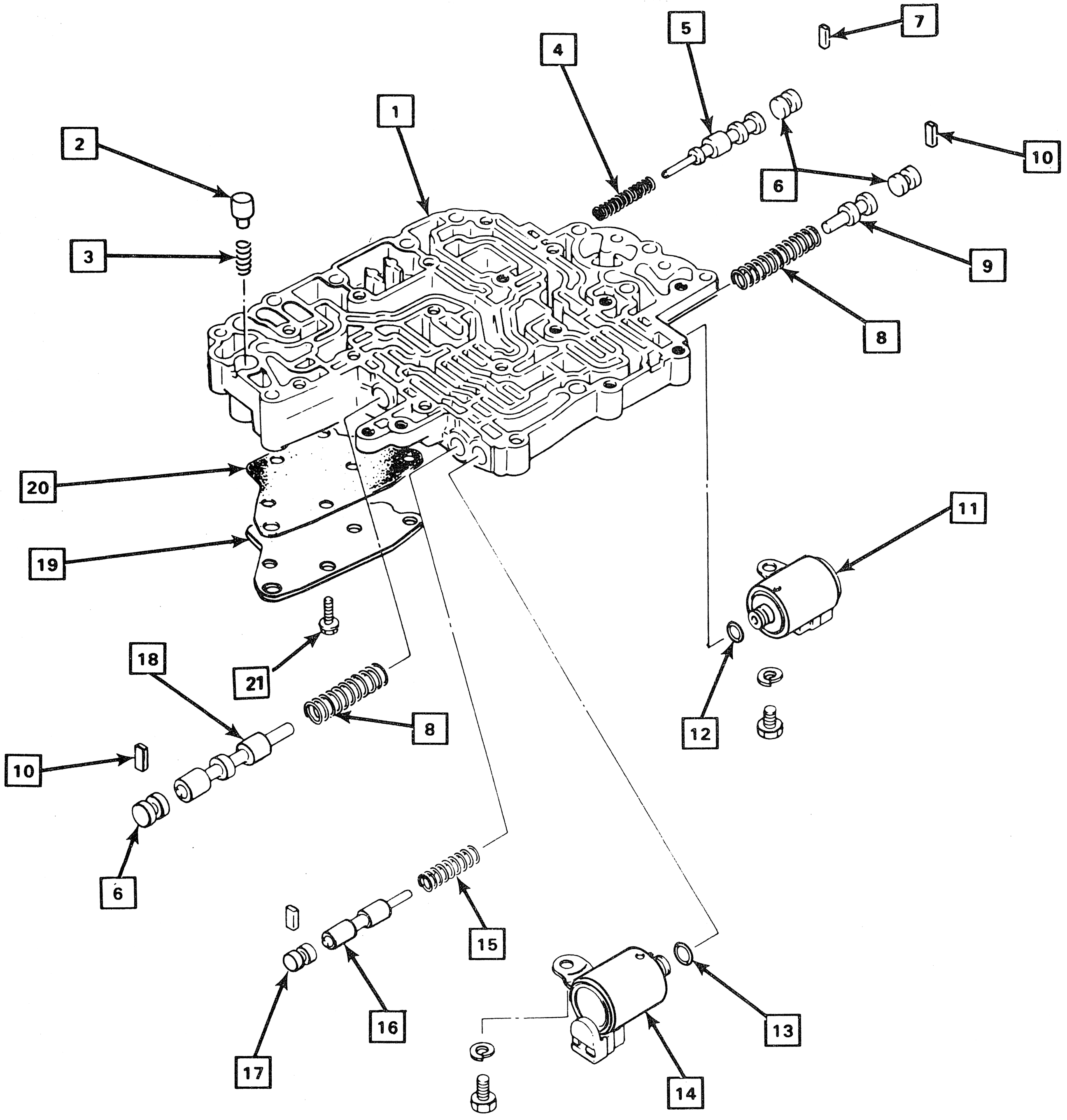
Install or Connect

1. Counter shaft spacer to case.
2. Counter shaft bearing (roller bearing) in case. Use J-35537 and J-7079-2 (Bearing Installer and Driver Handle). The bearing installer attachment has two sides used for installation of the counter shaft bearings (Figure 7A1-140).
3. Snap ring.
4. Another counter shaft bearing (ball bearing) to case. Use J-35537 and J-7079-2 (Bearing Installer and Driver Handle).
5. Bearing backing plate and snap ring.



1. UPPER VALVE BODY
2. PRESSURE REGULATOR VALVE SLEEVE
3. NO. 1 KEY
4. PRIMARY REGULATOR VALVE PLUNGER
5. PLATE WASHER
6. PRIMARY REGULATOR VALVE SPRING (RED, LENGTH: 52.5mm)
7. PRIMARY REGULATOR VALVE
8. MANUAL VALVE
9. THROTTLE VALVE SPRING
10. THROTTLE VALVE CAM PIN
11. THROTTLE VALVE CAM
12. DOWN SHIFT PLUG
13. THROTTLE VALVE NO. 2 SPRING (PURPLE, LENGTH: 31.5mm)
14. THROTTLE VALVE
15. THROTTLE VALVE RING
16. THROTTLE VALVE NO. 1 SPRING (WHITE, LENGTH: 22.2mm)
17. THROTTLE VALVE CAM BOLT
18. NOZZLE NEUTRAL DRAIN

Figure 7A1-132 Upper Valve Body Components



1. LOWER VALVE BODY
2. COOLER BY-PASS VALVE
3. SPRING (ORANGE LENGTH: 19.9 mm)
4. SECONDARY REGULATOR VALVE SPRING
   (YELLOW LENGTH: 31.4 mm)
5. SECONDARY REGULATOR VALVE
6. PLUG
7. NO. 1 KEY
8. SHIFT VALVE SPRING
   (PINK LENGTH: 39.6mm)
9. 2-3 SHAFT VALVE
10. NO. 2 KEY
11. DIRECT CLUTCH SOLENOID
12. SEAL
13. SEAL
14. 2ND BRAKE SOLENOID
15. B2 CONTROL VALVE SPRING
    (BLUE LENGTH: 28.1 mm)
16. B2 CONTROL VALVE
17. B2 CONTROL VALVE PLUG
18. 1-2 SHIFT VALVE
19. LOWER VALVE BODY COVER
20. GASKET
21. LOWER VALVE BODY COVER BOLT

Figure 7A1-133 Lower Valve Body Components

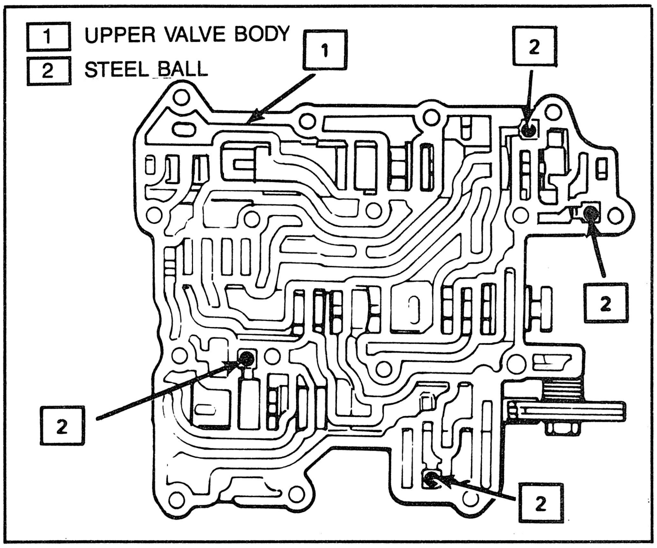


Figure 7A1-134 Four (4) Steel Balls Installation

BOLT	LENGTH	PIECES
A	29.5 mm (1.16 IN.)	6
B	38 mm (1.49 IN.)	6
C	44 mm (1.73 IN.)	2
D	REAMER BOLT	2

SPECIFIED TORQUE: 5-6 N·m
(3.7-4.3 lb. ft.)

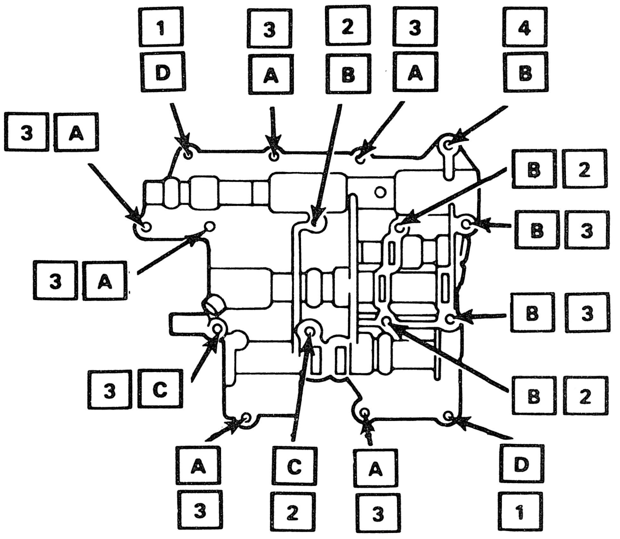


Figure 7A1-135 Upper Valve Body Bolts Installation

OUTPUT SHAFT BEARINGS

When replacing the output shaft bearings, remove the damaged bearing and install the new bearing as follows.

Remove or Disconnect

1. Output shaft bearings from output shaft by using J-22912-01 and a press (Bearing Puller). Do not reuse the removed bearing.

Install or Connect

1. New output shaft bearing on shaft using J-35539 and a press (Figures 7A1-141 and 142).

DIFFERENTIAL CASE

Disassembly

1. Remove the side bearings using puller J-28509-A and plug J-34851 (Figures 7A1-144 and 7A1-145).
2. Remove the speedometer drive gear using puller J-28509-A and plug J-34851.
3. Remove the roll pin retaining the pinion shaft (Figure 7A1-146).
4. Remove the pinion shaft, pinion gears and side gears from the case.
5. Remove the ring gear retaining bolts and then remove ring gears.

Cleaning and Inspection

Wash all parts thoroughly in cleaning solvent. Be sure all old lubricant, metallic particles, dirt, or foreign material are removed from the surfaces of every part.

Inspect all gear teeth for signs of excessive wear or damage. Remove minor nicks or scratches on an oil stone. Replace any part exhibiting excessive wear or damage. Inspect all thrust washers for evidence of excessive wear, distortion or damage. Replace any of these parts if they exhibit these conditions.

Assembly

Apply clean Automatic Transmission Fluid to the sliding surfaces of all parts before assembling.

1. Install the side washers and then the side gears.
2. Install the pinion washers and pinion gears.
3. Install the pinion gear shaft.
4. Measure the backlash of the side pinions and side gears with a feeler gage as shown in Figure 7A1-147. If the backlash exceeds the specified value, adjust it by varying the thickness of the side gear washers. Refer to Figure 7A1-148 for available side gear washer sizes.
5. Install the pinion shaft roll pin.
6. Install the ring gear and eight (8) retaining bolts as shown in Figure 7A1-149. Torque bolts to specification.
7. Install the speedometer gear as shown in Figure 7A1-150.
8. Install the RH and LH side bearings as shown in Figure 7A1-51.

   Install the bearings with the seal side facing the differential case.

   Installation

ASSEMBLY OF TRANSAXLE

General Assembly Instructions

1. Automatic transaxle consists of highly precise parts. As even a flaw in a small part may cause oil leakage or decrease in function, check each part carefully before installation.
2. Be sure to torque each bolt and nut to specification.

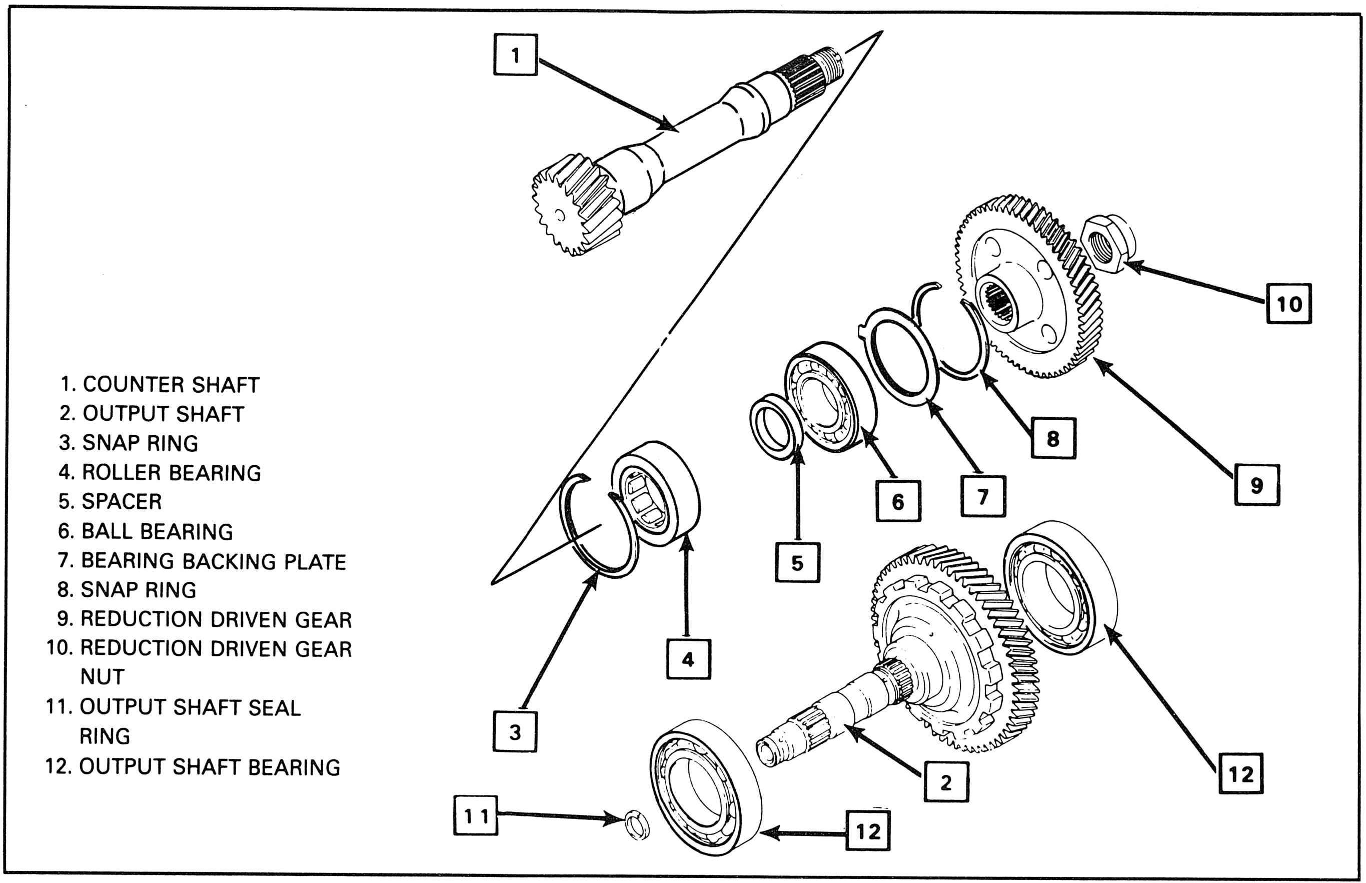

1. COUNTER SHAFT
2. OUTPUT SHAFT
3. SNAP RING
4. ROLLER BEARING
5. SPACER
6. BALL BEARING
7. BEARING BACKING PLATE
8. SNAP RING
9. REDUCTION DRIVEN GEAR
10. REDUCTION DRIVEN GEAR NUT
11. OUTPUT SHAFT SEAL RING
12. OUTPUT SHAFT BEARING
1
2
3
4
5
6
7
8
9
10
11
12
12

Figure 7A1-136 Counter Shaft and Output Shaft

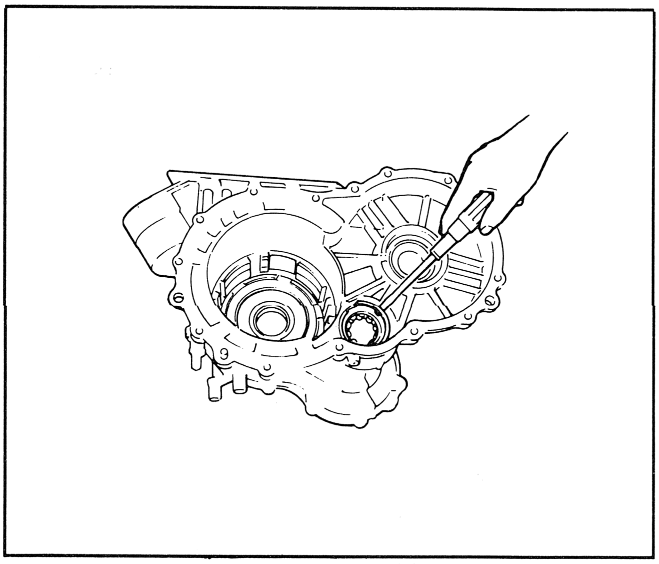


Figure 7A1-137 Removing Snap Ring

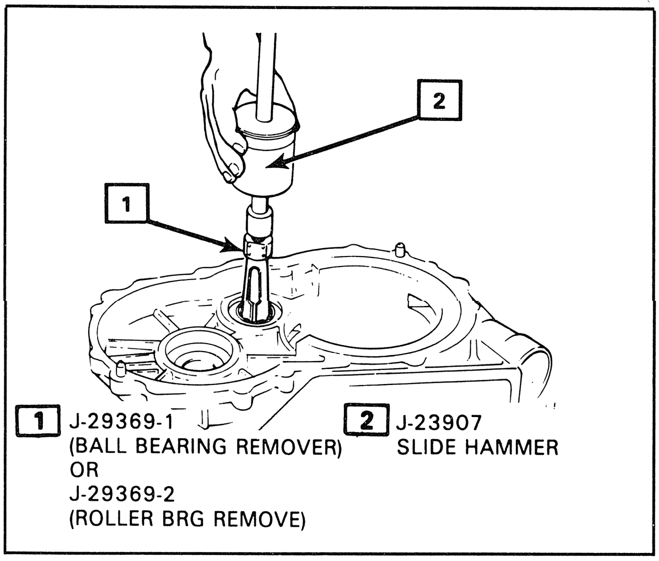

2
1
1 J-29369-1
(BALL BEARING REMOVER)
OR
J-29369-2
(ROLLER BRG REMOVE)
2 J-23907
SLIDE HAMMER

Figure 7A1-138 Removing Bearing

3. Before assembling new clutch discs and brake band, soak them in automatic transmission fluid for at least two (2) hours.
4. Apply automatic transmission fluid on sliding or rotating surfaces of the parts before assembly.
5. Do not use adhesive cements on gaskets and similar parts.
6. When assembling transaxle, be sure to use new gaskets and "O" rings.
7. Clean all parts with compressed air.
8. Be sure to install thrust bearings and races in correct direction and position as shown in Figure 7A1-152.

Install or Connect

1. Manual shift shaft and parking lock pawl.
   a. Install lower washer and parking lock rod to manual shift shaft.
   b. Manual shift shaft into transaxle case, and then the manual detent spring. Torque bolt and nut of manual detent spring to 8 - 12 N·m (6.0 - 8.5 lb.ft.).

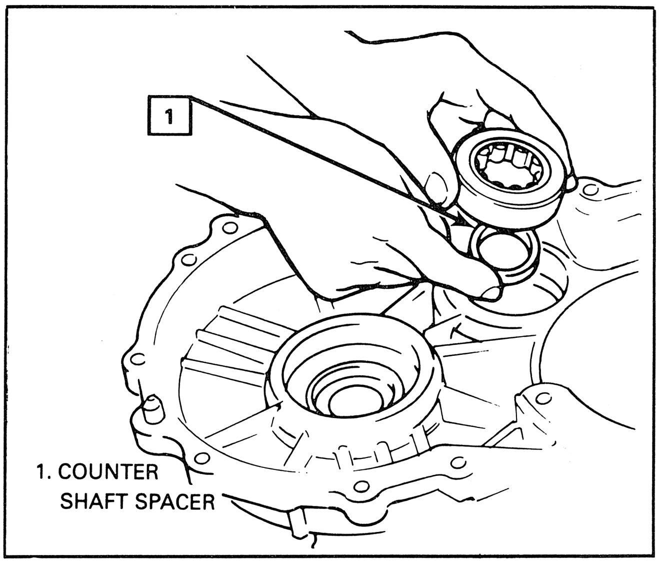


Figure 7A1-139 Installing Counter Shaft Spacer

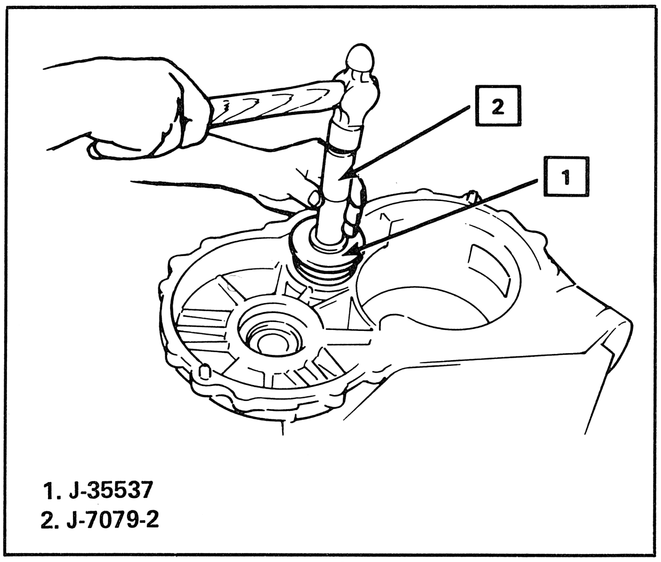


Figure 7A1-140 Installing Counter Shaft Bearing

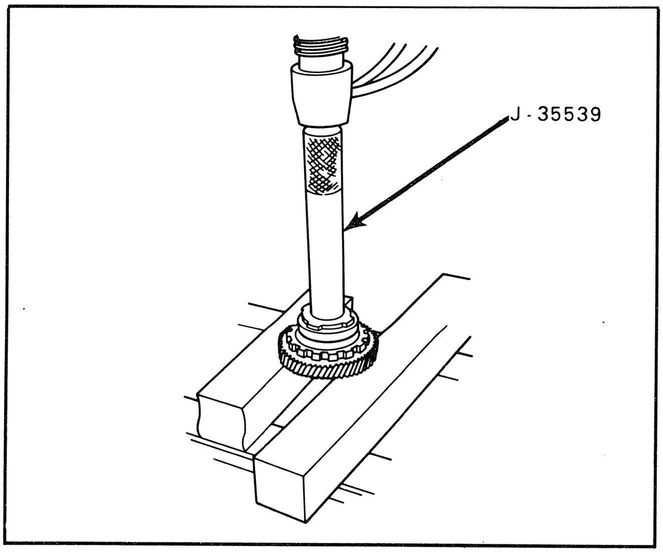


Figure 7A1-141 Installing Output Shaft Bearing

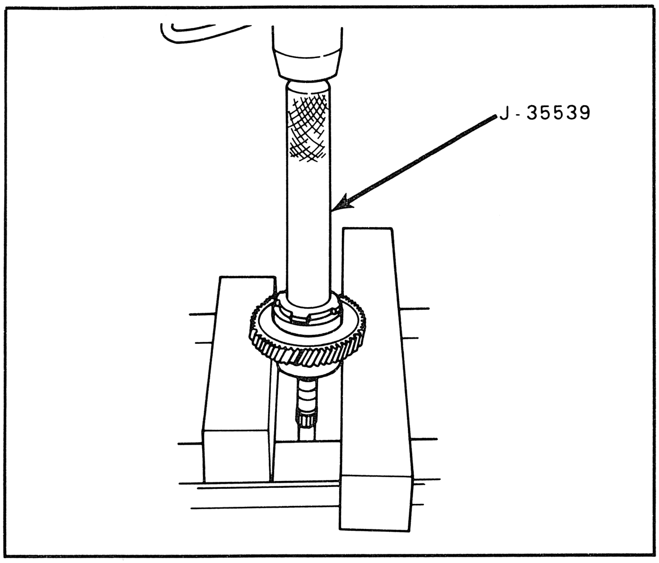


Figure 7A1-142 Installing Output Shaft Bearing

Use care when installing so that manual shift shaft will not damage oil seal lip when passing through it.

c. Shift shaft upper washer and the manual shift lever to manual shift shaft. Tighten two (2) nuts (Upper and lower nuts) as follows. See Figure 7A1-156.
   - Tighten lower nut to 27 - 33 N·m (20 - 23.5 ft.lb.).
   - Tighten upper nut to 27 - 33 N·m (20 - 23.5 ft.lb.).

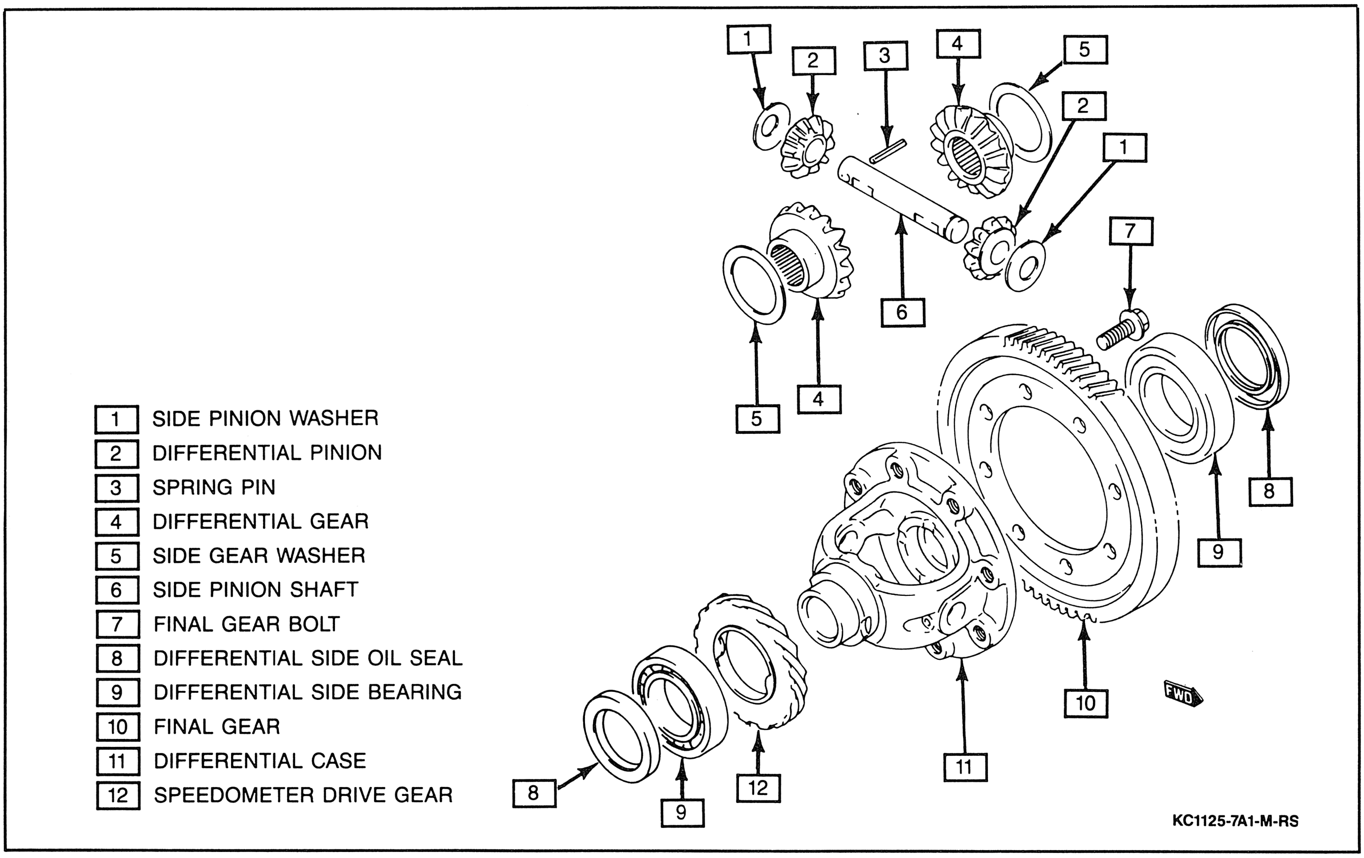
d. After tightening nuts, check manual shift shaft for smooth rotation.

e. Restrictor pin and snap ring to parking lock pawl sleeve and then install to case.

f. Parking lock pawl.
   - Shift manual shift lever to a position other than "parking" position.
   - Install parking lock pawl.
   - Install lock pawl shaft and lock pawl spring. Check to make sure that parking lock pawl moves smoothly by moving manual shift lever.

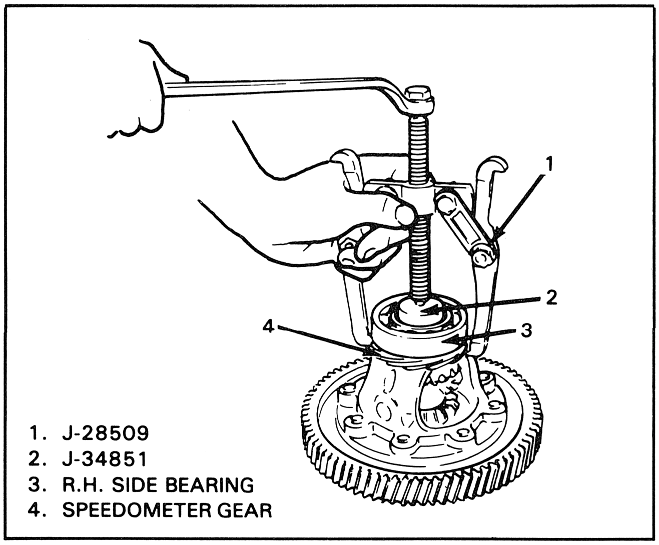
2. 1st-reverse brake piston.
   a. Apply Automatic Transmission Fluid to the new inner and outer seals ("O" rings) and fit them to piston.
   b. Insert piston into case in such a way that the side with spring holes comes to the top (Figure 7A1-159). Make sure that seals are not twisted or caught.
   c. Place return spring assembly on the piston. Check to make sure that each spring of the return spring assembly is fitted securely in the spring holes of the piston.
   d. Push down return spring assembly and install snap ring (Figure 7A1-160).

3. Counter shaft.
   a. Using J-35608 and J-7079-2 and a hammer, install counter shaft.



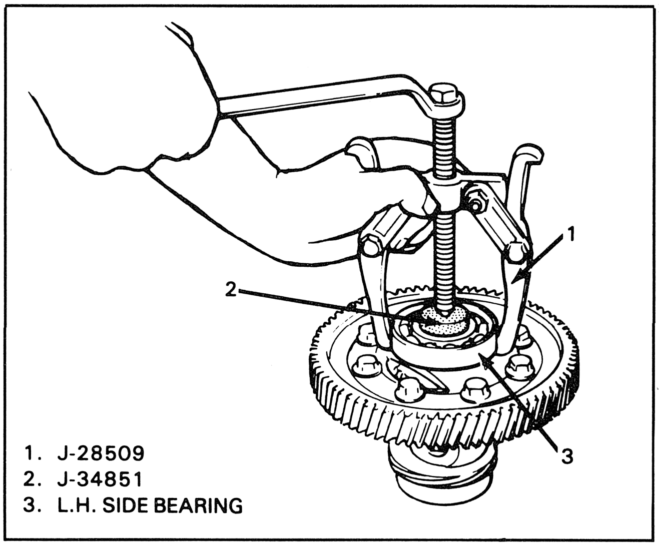
1 SIDE PINION WASHER
2 DIFFERENTIAL PINION
3 SPRING PIN
4 DIFFERENTIAL GEAR
5 SIDE GEAR WASHER
6 SIDE PINION SHAFT
7 FINAL GEAR BOLT
8 DIFFERENTIAL SIDE OIL SEAL
9 DIFFERENTIAL SIDE BEARING
10 FINAL GEAR
11 DIFFERENTIAL CASE
12 SPEEDOMETER DRIVE GEAR

Figure 7A1-143 Differential Assembly Cross-Section



1. J-28509
2. J-34851
3. R.H. SIDE BEARING
4. SPEEDOMETER GEAR

Figure 7A1-144 Removing RH Side Bearing



1. J-28509
2. J-34851
3. L.H. SIDE BEARING

Figure 7A1-145 Removing LH Side Bearing

b. When inserting counter shaft into case, check to make sure that spacer is in the position as shown in Figure 7A1-161.

c. Do not hammer shaft excessively hard or snap ring and case could be damaged.

4. Output shaft.

   a. Shift manual shift lever to a position other than "parking" position.

   b. Using a J-35539 (Bearing Installer) and a hammer, install output shaft.

5. Reduction driven gear on the counter shaft.

   a. Shift manual shift lever to "parking" position so that output shaft is locked and cannot turn.

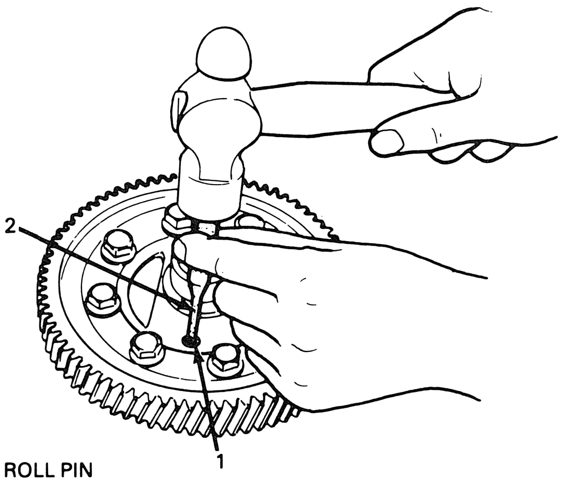
   b. Tighten driven gear nut to specification (Figure 7A1-163).

   c. Using a chisel and a hammer, stake the driven gear nut at two places (Figure 7A1-164).

6. Transaxle rear cover.

   a. Install a new rear cover gasket.

   b. Install rear cover. Check that output shaft bearing enters rear cover bearing hole

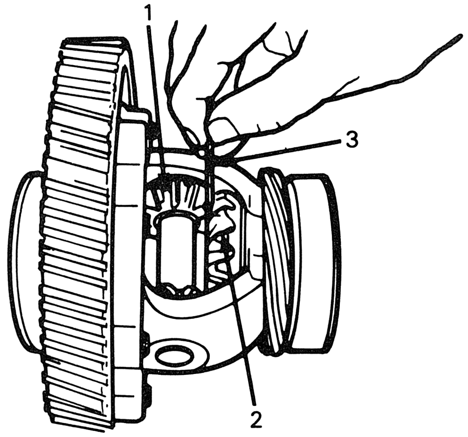


1. ROLL PIN
2. DRIFT

Figure 7A1-146 Removing Side Pinion Shaft

SPECIFICATION

0.01 – 0.25 mm
(0.000 – 0.009 IN.)

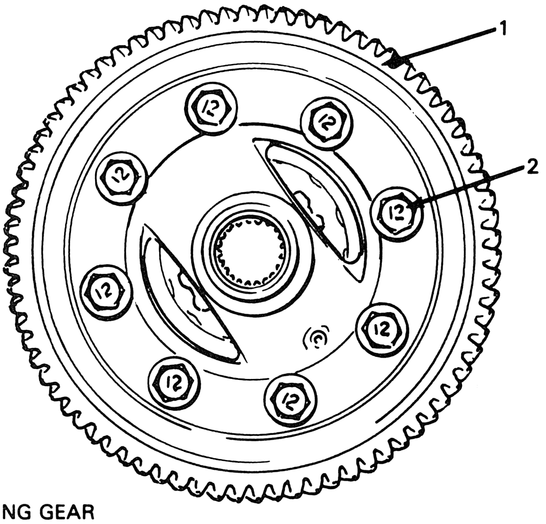


1. SIDE PINION
2. SIDE GEAR
3. FEELER GAGE

Figure 7A1-147 Measuring Backlash

	mm	IN.
Available side gear	0.90	0.035
	0.95	0.037
Washer sizes	1.00	0.039
	1.05	0.041
	1.10	0.043
	1.15	0.045
	1.20	0.047

Figure 7A1-148 Side Gear Washer Size



1. RING GEAR
2. RING GEAR BOLTS (8)
80 – 100 N·m
(58 – 72 FT. LBS.)

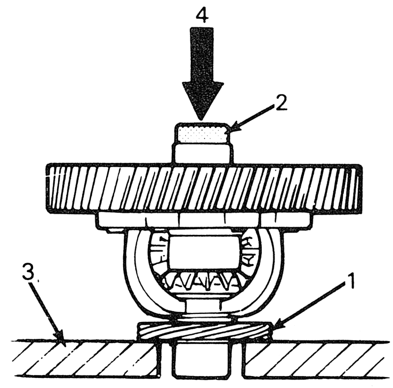
Figure 7A1-149 Ring Gear Bolts

smoothly. Check for abnormal gear sound by rotating output shaft.

c. Install five (5) of the ten (10) cover bolts and two (2) retaining nuts. Install the remaining five (5) bolts after the holding fixture J-35525 is removed.

7. Using J-35539 (Output Shaft Remover/Installer) and a hammer, seat the shaft against rear cover side.
   a. Fit four (4) projections of J-35539 (Output Shaft Remover/Installer) to the four (4) notches in the case shown in Figure 7A1-166.
   b. Seat bearing and output shaft against rear cover side by tapping J-35539 with a hammer lightly (Figure 7A1-167).
      - Make sure to use J-35539. Do not tap output shaft directly with a hammer.

8. Differential gear assembly engaging teeth of final gear and counter shaft gear. Be careful not to damage gear tooth surfaces.
9. 1st-reverse brake parts.
   a. Install damper plate to the return spring assembly with convex side upward (Figure 7A1-169). Use care not to install in the reverse direction.
   b. Install discs, plates and flange (Figure 7A1-170). Install in the following order:
      1. Plate
      2. Disc
      3. Plate
      4. Disc
      5. Plate
      6. Disc
      7. Plate



1. SPEEDOMETER GEAR
2. J-34851
3. SUPPORT
4. PRESS

Figure 7A1-150 Speedometer Drive Gear

8. Disc
9. Flange (Flat side down)

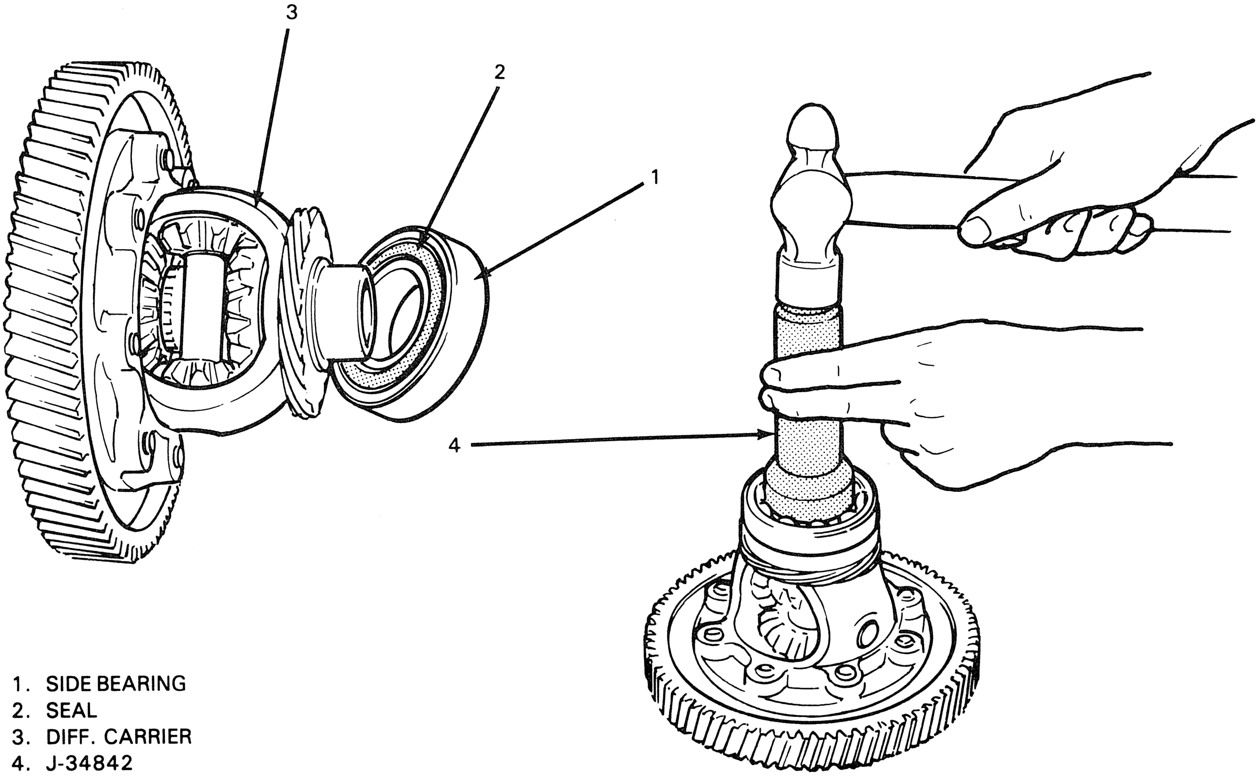
NOTICE: When using new discs for installation, soak them in Automatic Transmission Fluid for more than two (2) hours before installation.

c. Install snap ring.

10. Measure 1st-reverse brake clutch clearance. Measure clearance between snap ring and flange.
11. Check 1st-reverse brake piston for operation. Check for piston movement by applying air into oil hole shown in Figure 7A1-172.
12. Rear planetary ring gear. Engage ring gear and output shaft spline, and insert.
13. Rear planetary ring gear races and bearing. Install in the following order:
    a. Race (flange side up)
    b. Bearing
    c. Race (flange side up)

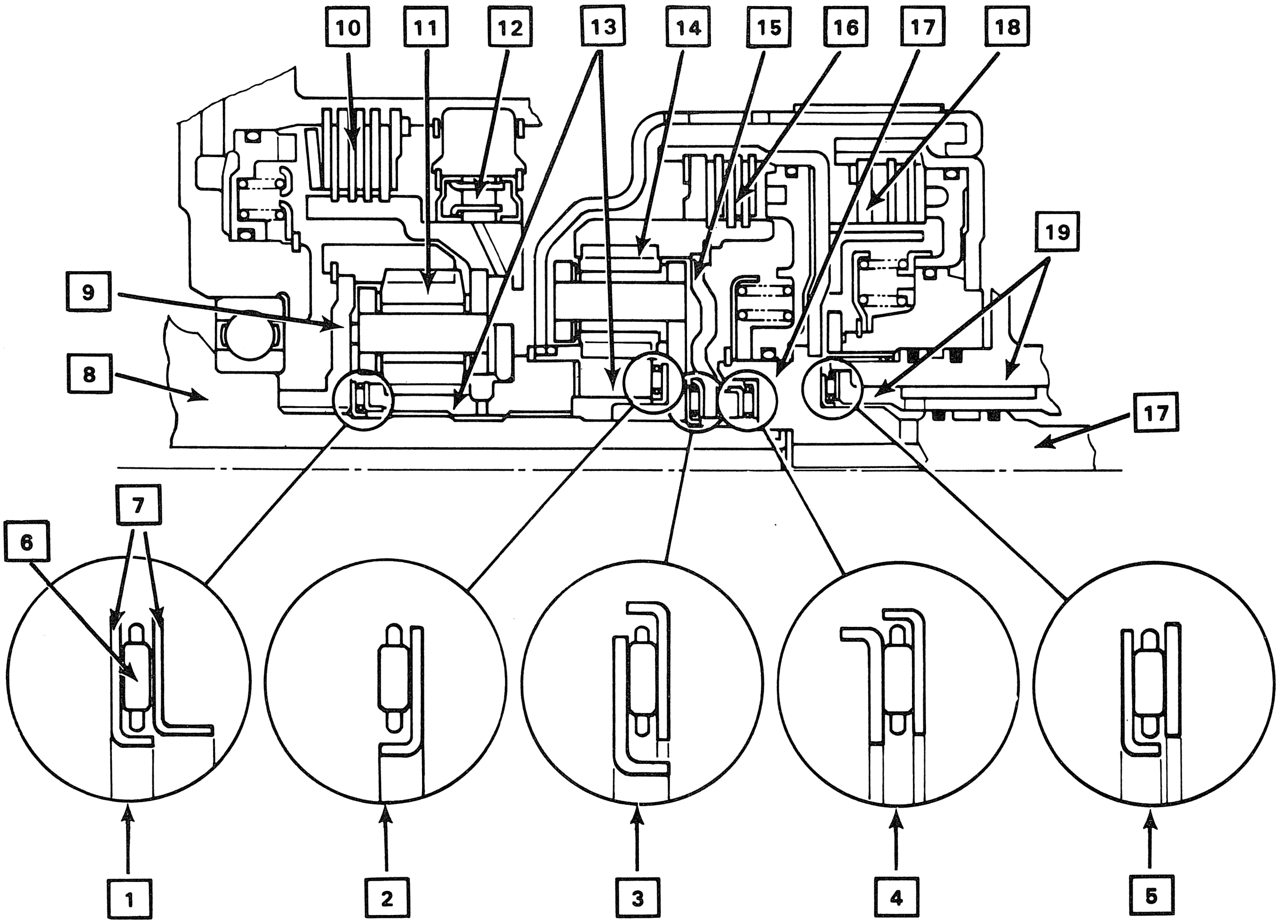
    For proper positions and directions of ring gear races installation, refer to Figure 7A1-152.
14. Rear planetary thrust washers on the rear planetary gear assembly.

    Apply grease to thrust washers and place them before and after the gear assembly, one each. Make sure that different lug shapes match slots in gear assembly.
15. Rear planetary gear assembly (Figure 7A1-176). Install with the teeth of 1st-reverse brake discs aligned. After installing rear planetary gear assembly, check the thrust washers and races for proper installation by moving rear planetary gear assembly up and down lightly with hand. If gear assembly makes a clear sound like a "Click" when moved up and down, they are installed in place. But if no sound or a "Click" is heard, it is possible that washers or races are out of place. In such a case, remove gear assembly and check.
16. One-way clutch race snap ring into the groove of transaxle case.



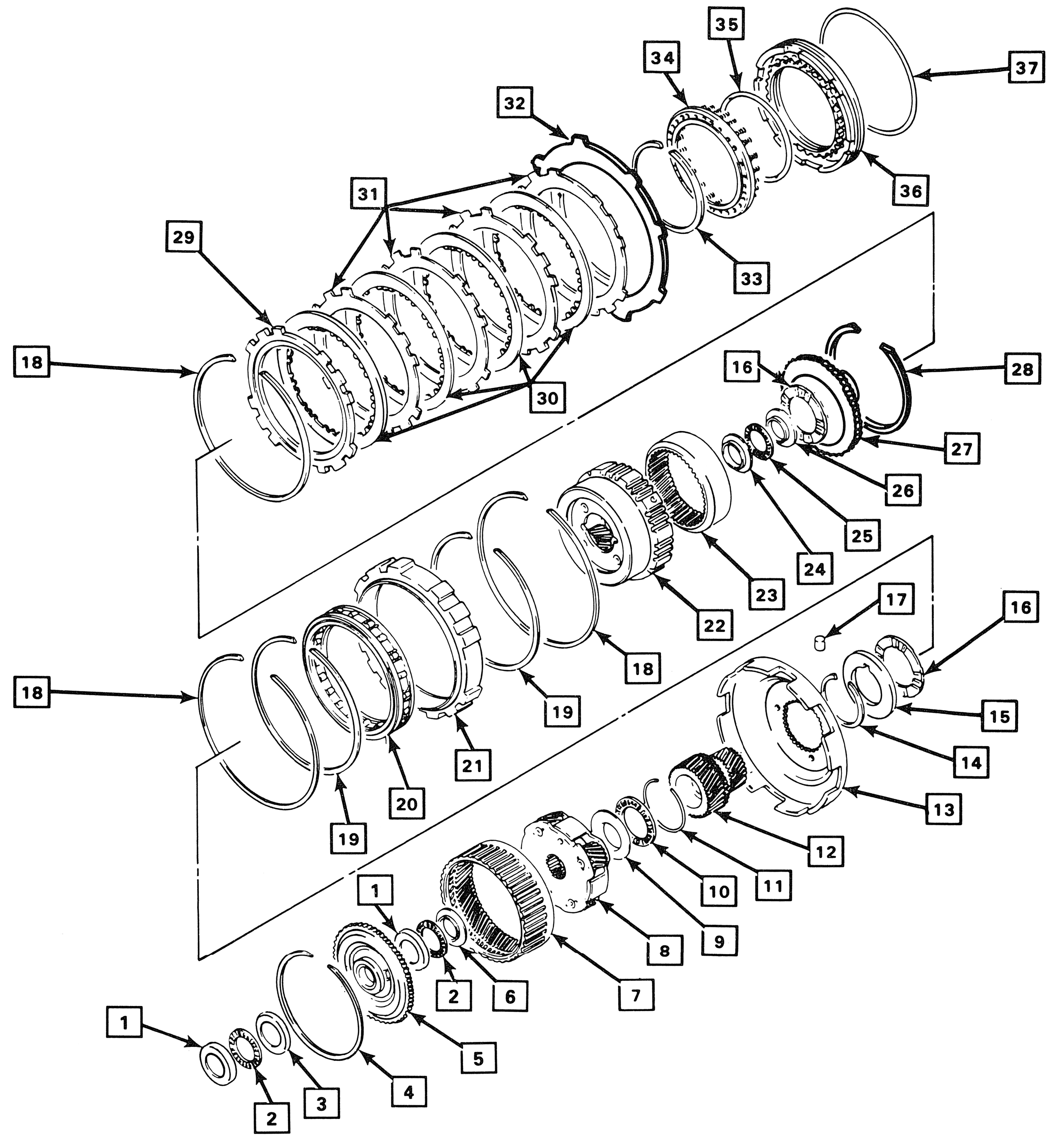
1. SIDE BEARING
2. SEAL
3. DIFF. CARRIER
4. J-34842

Figure 7A1-151 Installing Side Bearings



1. REAR RING GEAR RACES AND BEARING
2. FRONT PLANETARY GEAR RACE AND BEARING
3. RING GEAR RACES AND BEARING
4. RING GEAR RACES AND BEARING
5. INPUT SHAFT BEARING AND RACES
6. BEARING
7. RACE
8. OUTPUT SHAFT
9. RING GEAR FLANGE
10. 1ST-REVERSE BRAKE
11. REAR PLANETARY GEAR
12. ONE-WAY CLUTCH
13. SUN GEAR
14. FRONT PLANETARY GEAR
15. REAR GEAR FLANGE
16. FORWARD CLUTCH
17. INPUT SHAFT
18. DIRECT CLUTCH
19. OIL PUMP

Figure 7A1-152 Thrust Bearings and Races



1. RING GEAR RACE	14. SNAP RING	27. RING GEAR FLANGE
2. RING GEAR BEARING	15. PLANETARY THRUST WASHER	28. RING GEAR SNAP RING
3. RING GEAR RACE	16. REAR PLANETARY THRUST WASHER	29. 1ST-REVERSE BRAKE FLANGE
4. SNAP RING	17. SUN GEAR PIN	30. 1ST-REVERSE BRAKE DISC
5. RING GEAR FLANGE	18. ONE-WAY CLUTCH RACE SNAP RING	31. 1ST-REVERSE BRAKE PLATE
6. RING GEAR RACE	19. ONE-WAY CLUTCH SNAP RING	32. 1ST-REVERSE BRAKE DAMPER PLATE
7. FRONT PLANETARY RING GEAR	20. ONE-WAY CLUTCH	33. RETURN SPRING SNAP RING
8. FRONT PLANETARY GEAR ASS'Y	21. ONE-WAY CLUTCH RACE	34. 1ST-REVERSE BRAKE RETURN SPRING
9. FRONT PLANETARY GEAR RACE	22. REAR PLANETARY GEAR ASS'Y	35. PISTON INNER SEAL
10. FRONT PLANETARY GEAR BEARING	23. REAR PLANETARY RING GEAR	36. 1ST-REVERSE BRAKE PISTON
11. INPUT DRUM SNAP RING	24. REAR RING GEAR RACE	37. PISTON OUTER SEAL
12. SUN GEAR	25. RING GEAR BEARING	
13. SUN GEAR INPUT DRUM	26. REAR RING GEAR RACE	

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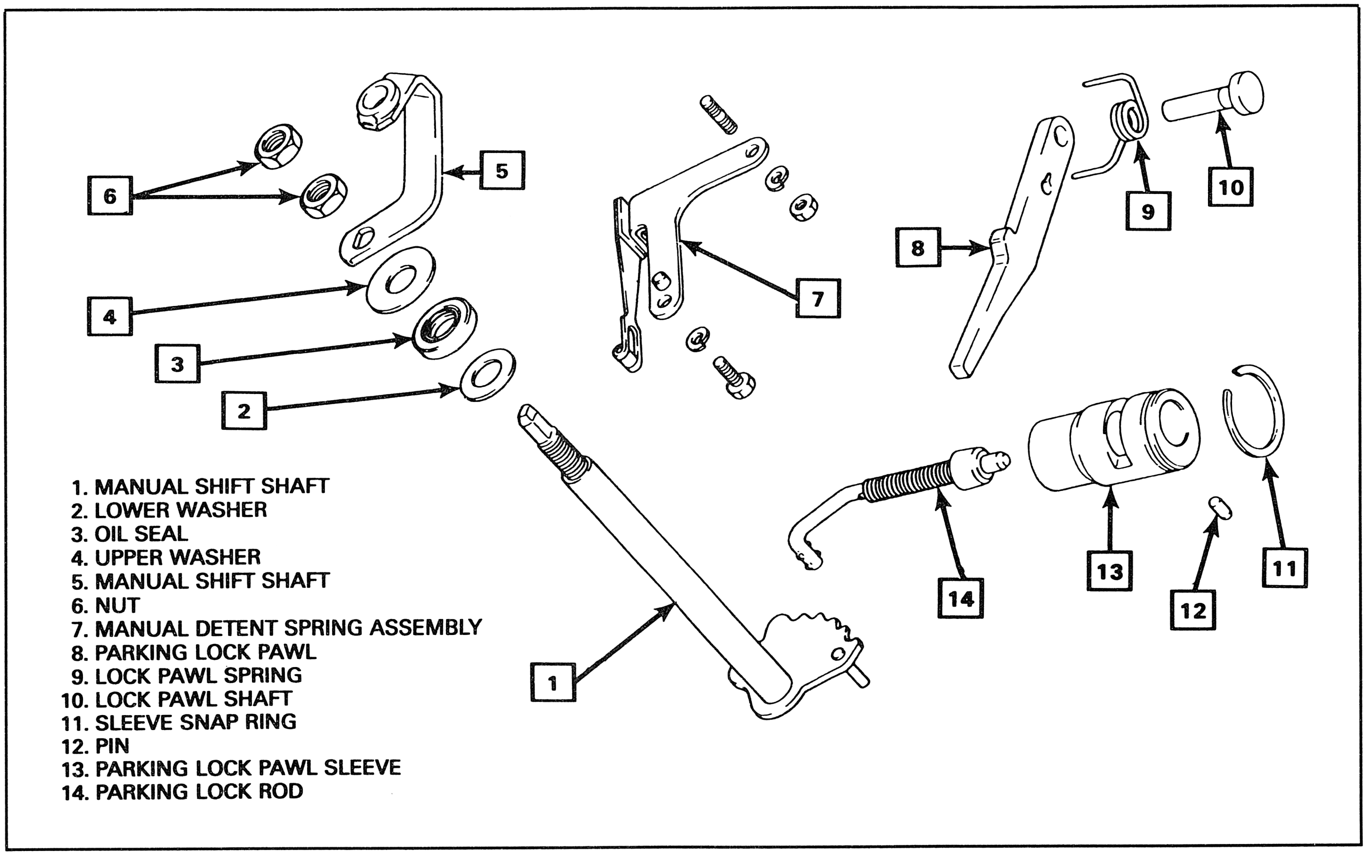
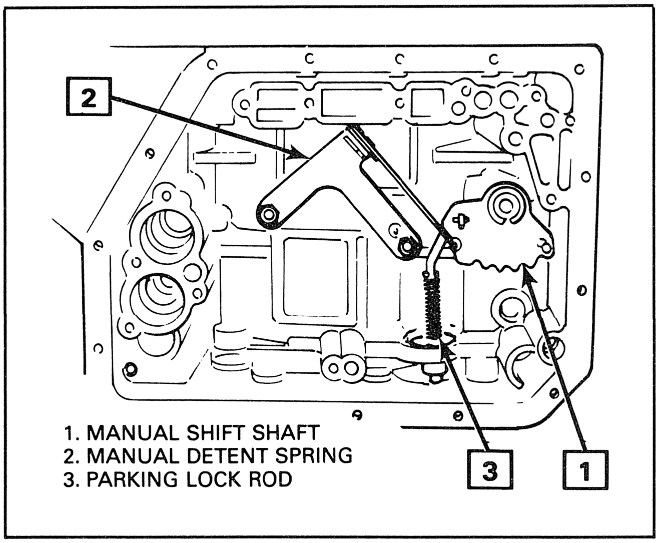
Figure 7A1-153 Planetary Gears and Related Parts



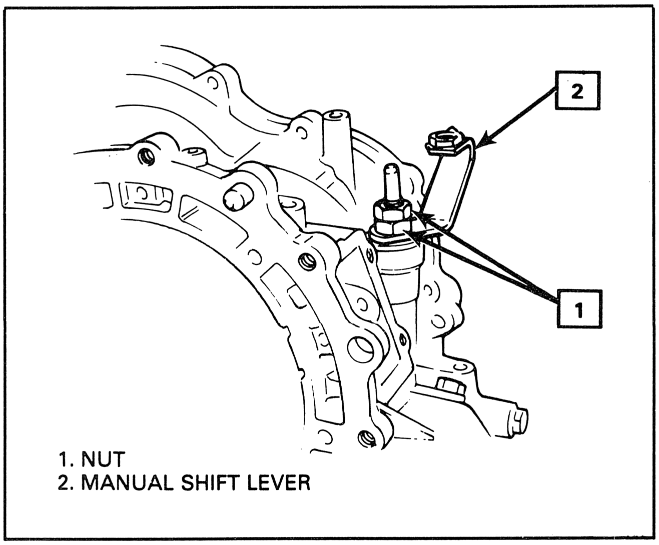
1. MANUAL SHIFT SHAFT
2. LOWER WASHER
3. OIL SEAL
4. UPPER WASHER
5. MANUAL SHIFT SHAFT
6. NUT
7. MANUAL DETENT SPRING ASSEMBLY
8. PARKING LOCK PAWL
9. LOCK PAWL SPRING
10. LOCK PAWL SHAFT
11. SLEEVE SNAP RING
12. PIN
13. PARKING LOCK PAWL SLEEVE
14. PARKING LOCK ROD

Figure 7A1-154 Manual Shift Shaft, Parking Lock Pawl and Related Parts



1. MANUAL SHIFT SHAFT
2. MANUAL DETENT SPRING
3. PARKING LOCK ROD

Figure 7A1-155 Installing Manual Shift Shaft and Manual Detent Spring



1. NUT
2. MANUAL SHIFT LEVER

Figure 7A1-156 Upper and Lower Nuts

17. One-way clutch (Figure 7A1-176). Place the one-way clutch on the rear planetary gear assembly while turning planetary gear assembly clockwise by hand, insert one-way clutch to correct position.

NOTICE: One-way clutch must be installed in a certain direction. Check for its proper installation as follows (Figure 7A1-177).

After installing one-way clutch to the rear planetary gear, try turning rear planetary gear clockwise by hand. If it turns clockwise smoothly (freely), that proves the proper installation of the one-way clutch. However, if it doesn't turn clockwise (locked) and turns counterclockwise smoothly, it means that the one-way clutch is installed in the wrong direction. In such a case, remove one-way clutch, reinstall it in opposite direction and carry out the above described check again to make sure that the planetary gear turns smoothly only clockwise.

18. One-way clutch race snap ring. Push snap ring into place by hand. Visually check to make sure that the snap ring is fully seated. Also, make sure that the ends of the snap ring are between lugs.

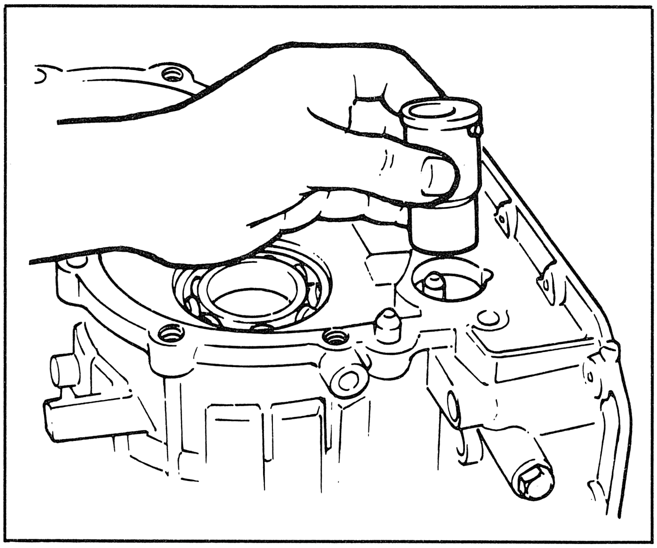
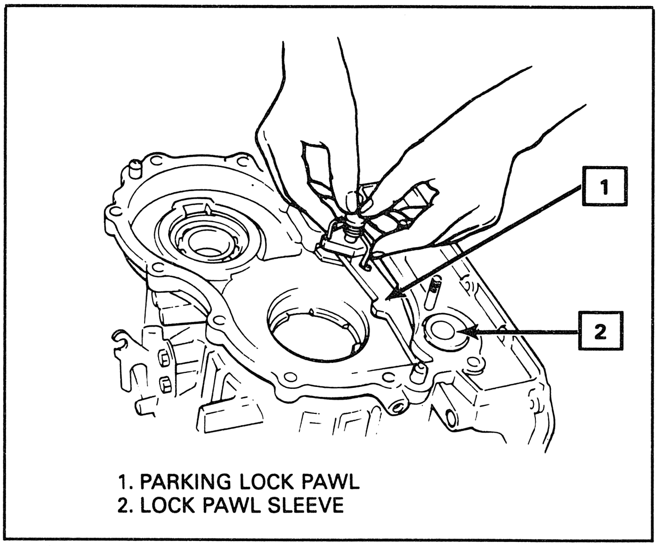


Figure 7A1-157 Installing Parking Lock Pawl Sleeve



1. PARKING LOCK PAWL
2. LOCK PAWL SLEEVE

Figure 7A1-158 Installing Lock Pawl Shaft and Lock Pawl Spring

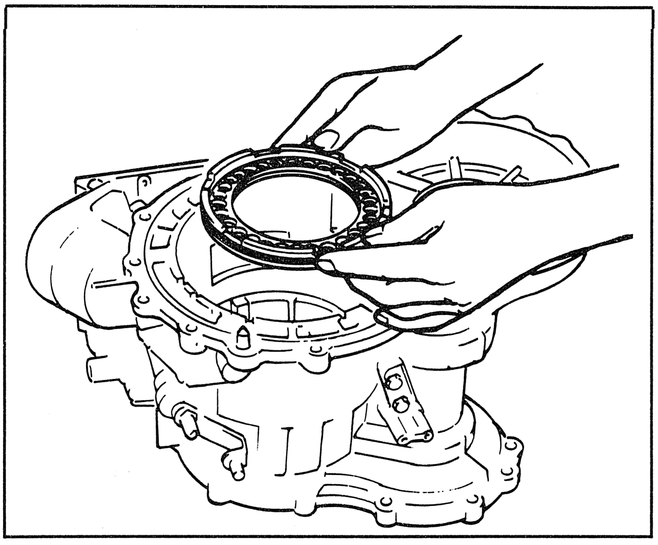


Figure 7A1-159 Installing Return Spring Assembly

19. Sun gear pin and thrust washer on the sun gear assembly. Apply grease to the thrust washer so that it will not fall off. Check to make sure that the pin is fitted in the thrust washer notch.

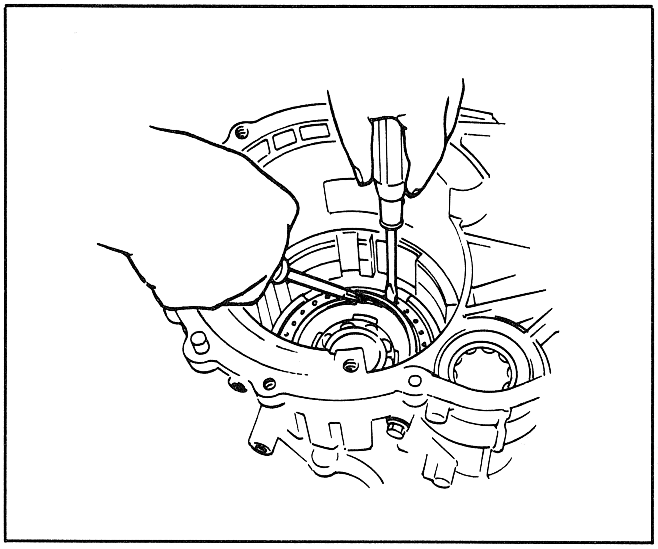
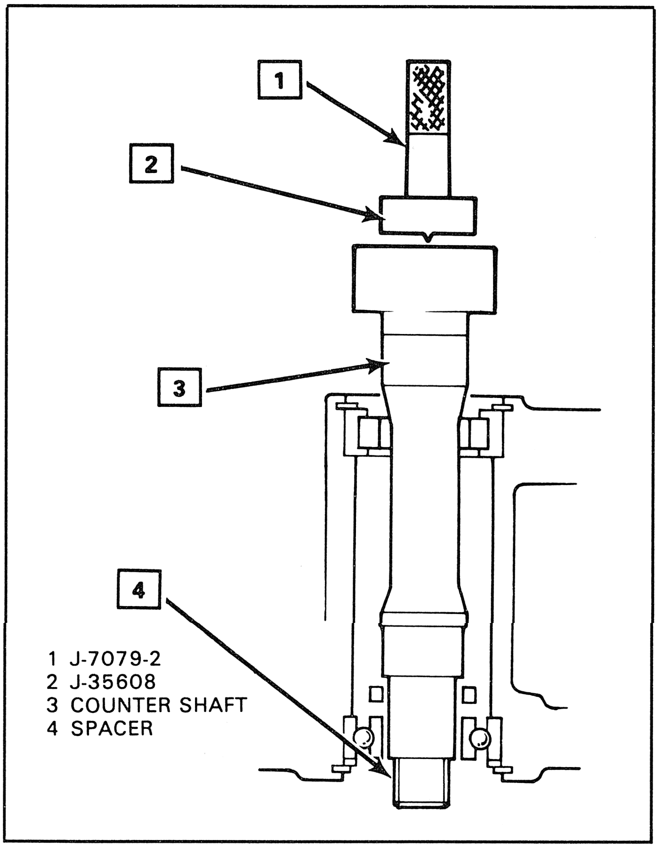


Figure 7A1-160 Installing Snap Ring



1 J-7079-2
2 J-35608
3 COUNTER SHAFT
4 SPACER

Figure 7A1-161 Installing Counter Shaft

20. Sun gear assembly. Push in sun gear while engaging it with the rear planetary gear. Be careful not to damage bushing inside sun gear. After installing sun gear, check thrust washers for proper installation by moving sun gear up and down lightly with fingers. If the sun gear makes a clear sound like a "Click" when moved up and down, they are installed in place. But if no sound

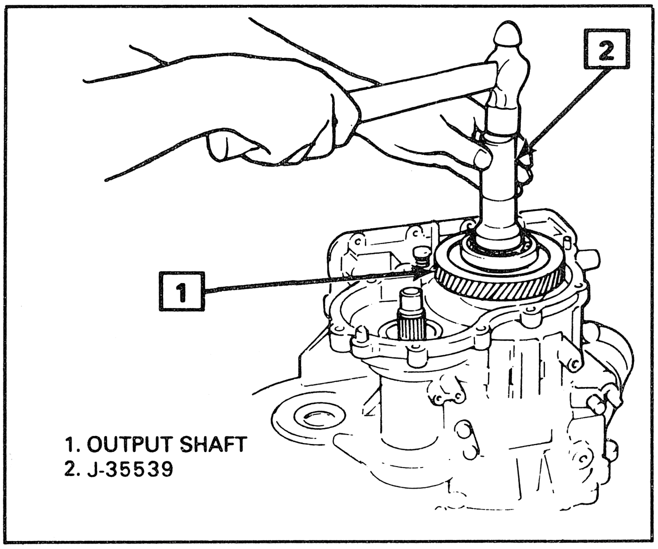


Figure 7A1-162 Installing Output Shaft

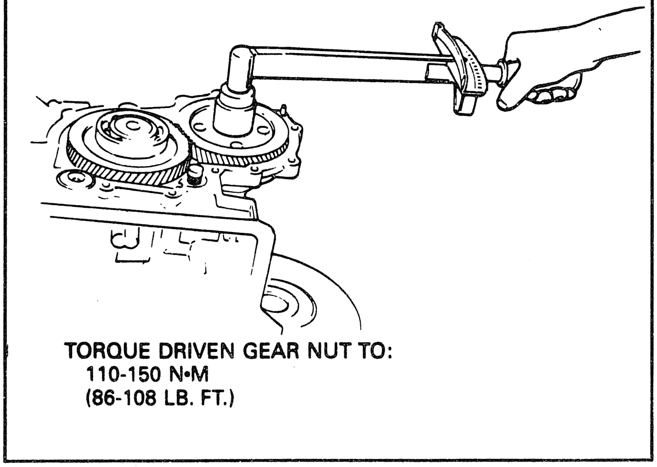


Figure 7A1-163 Tightening Driven Gear Nut

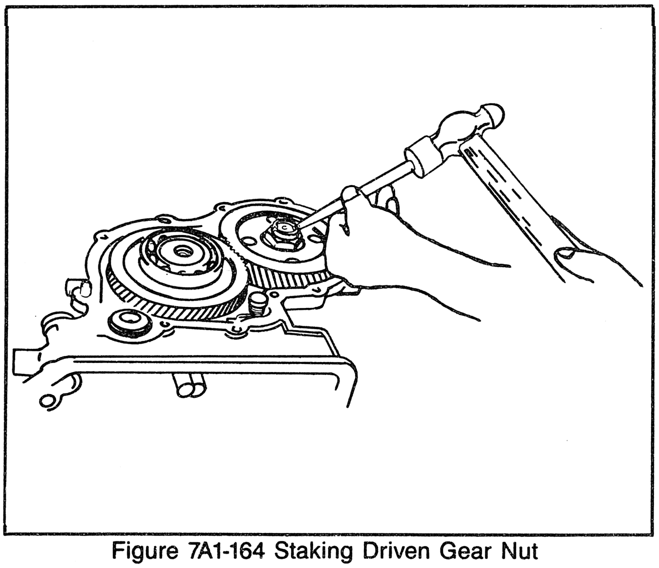


Figure 7A1-164 Staking Driven Gear Nut

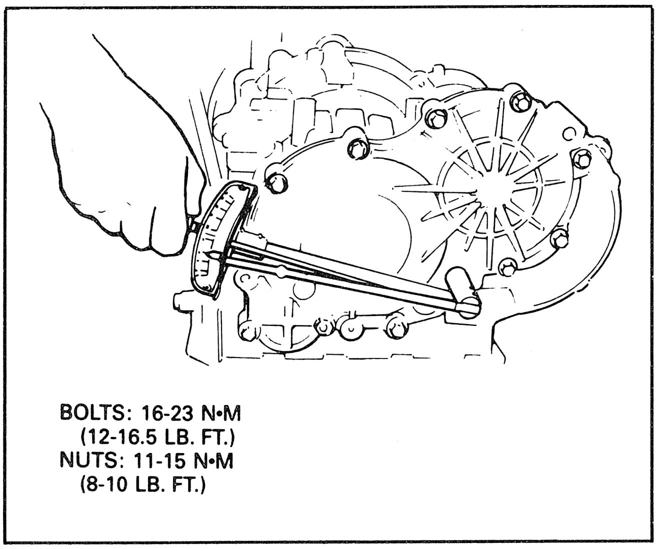


Figure 7A1-165 Installing Rear Cover

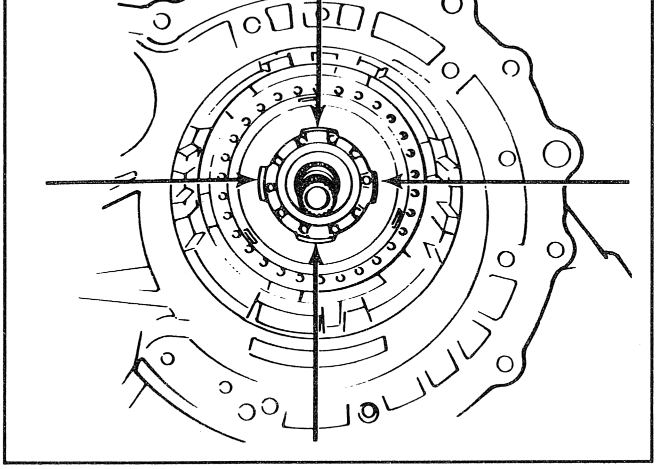


Figure 7A1-166 Four (4) Notches

or "Click" is heard, it is possible that washers are out of places. In such case, remove sun gear and check.

21. Front planetary gear bearing and race. Install on the sun gear in the following order. See Figure 7A1-152 for installation.
    a. Bearing
    b. Race (flange side down)
22. Front planetary gear assembly. Install front planetary gear assembly while turning it clockwise or counterclockwise.

    After installing the front planetary gear assembly, check bearing and race installed in step 21 for proper installation by moving planetary gear assembly up and down lightly with finger. If the planetary gear assembly makes a clear sound like a "Click" when moved up and down, they are installed in place. But if no sound or a "Click" is heard, it is possible that the bearing and race are out of position. In such a case, remove planetary gear assembly and check.

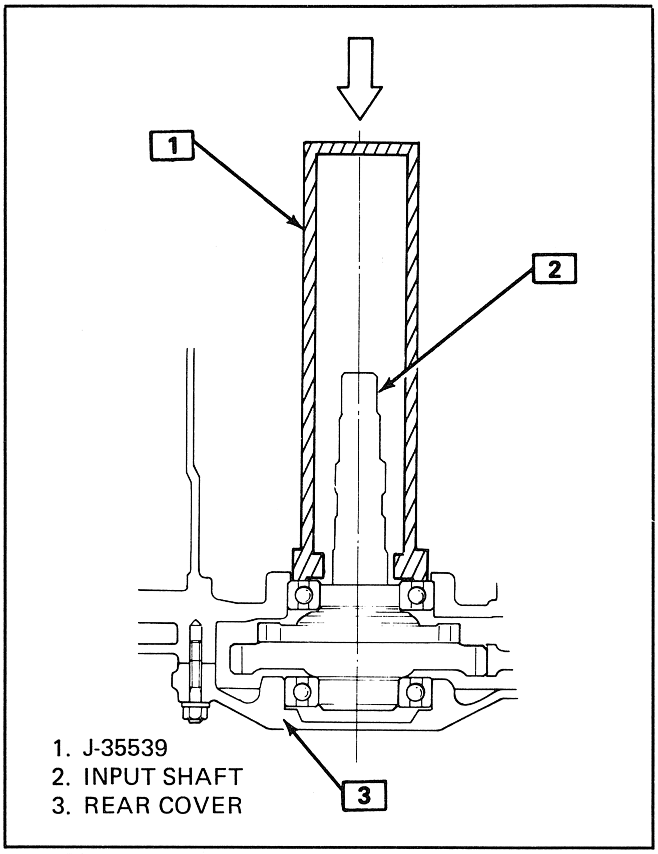


Figure 7A1-167 Seating Output Shaft Against Rear Cover

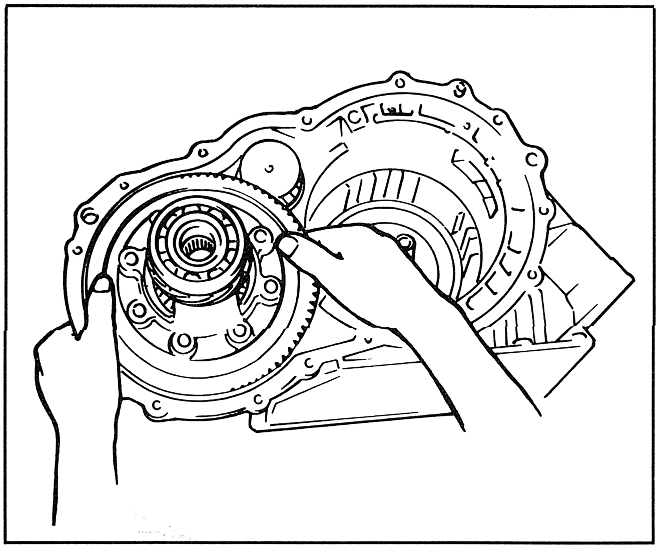


Figure 7A1-168 Installing Differential Gear Assembly

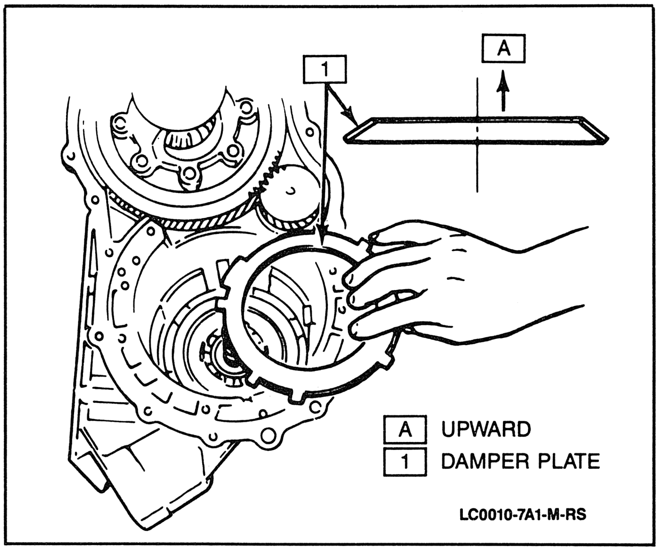


Figure 7A1-169 Installing Damper Plate

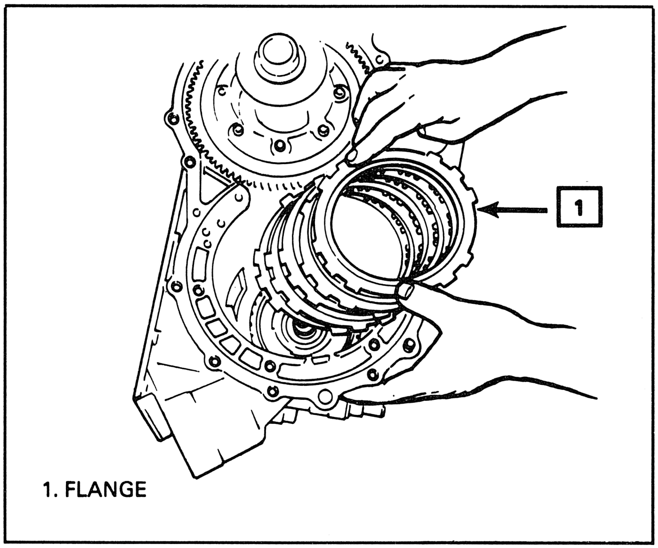


Figure 7A1-170 Installing Discs, Plates and Flange

23. Ring gear bearing and races on the front planetary gear assembly. See Figure 7A1-152 for proper installation. Install in the following order:
    a. Race (flange side up)
    b. Bearing
    c. Race (flange side down)
24. Front planetary ring gear assembly. After installing front planetary ring gear assembly, check the bearing and races installed in step 23 for proper installation by moving the ring gear assembly up and down lightly with fingers. *If ring* gear assembly makes a clear sound like a "Click" when moved up and down, they are installed in place. But if no sound or a "Click" is heard, it is possible that the bearing and races are out of position. In such a case, remove ring gear assembly and check.
25. Secondary brake band. After making sure for correct installing direction, install second brake band in the case. Use care not to bend the second brake band too much, or damage it, during installation.
26. 2nd brake piston.
    a. Put the piston spring, and the piston assembly into the case after applying Automatic Transmission Fluid to piston rod, seal and seal ring.
    b. Piston cover to the case after applying Automatic Transmission Fluid to two (2) cover seals.

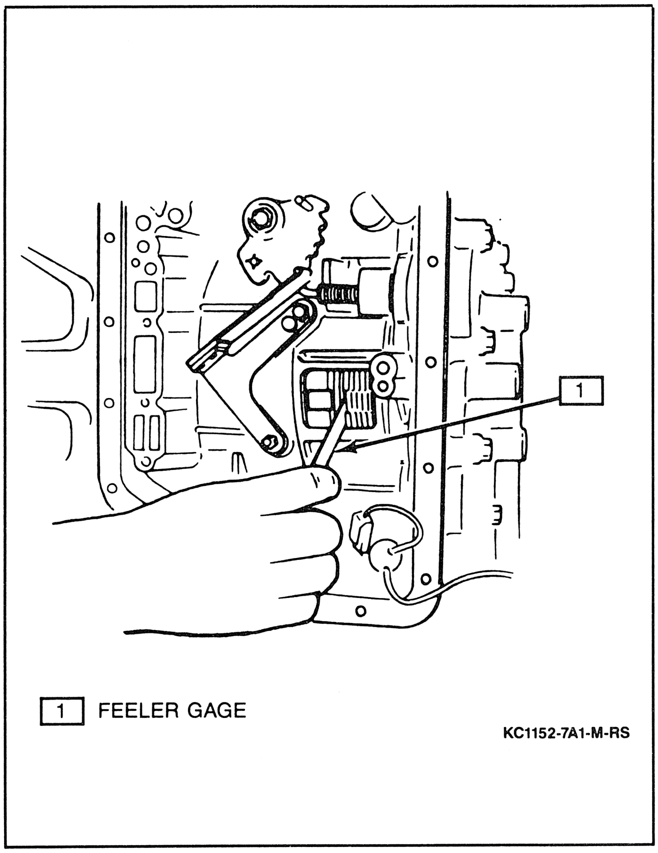


Figure 7A1-171 Measuring 1st-Reverse Brake Clutch Clearance

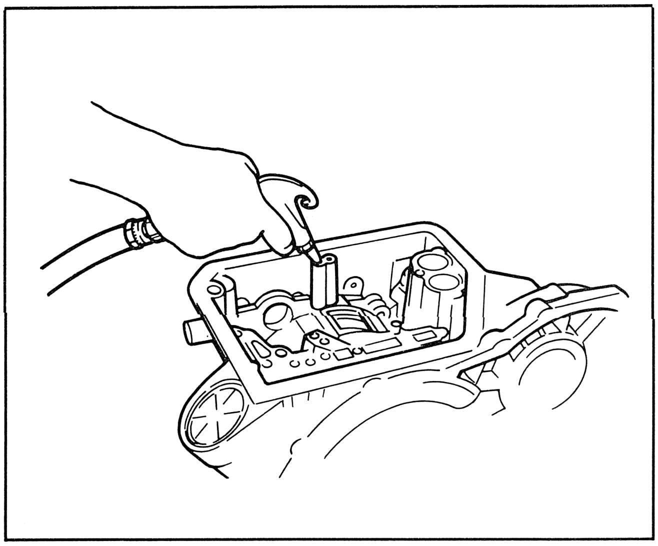


Figure 7A1-172 Checking 1st-Reverse Brake Piston Movement

c. Install J-35534 (Piston Cover Depressor) and compress piston cover and install snap ring (Figure 7A1-191).

27. Inspect the output shaft seal ring for wear or damage and replace if necessary. Do not expand the seal ring excessively when installing.

28. Input shaft seal rings on the input shaft. When installing input shaft seal rings, apply grease to grooves in the input shaft before installation. Do not expand seal ring excessively.

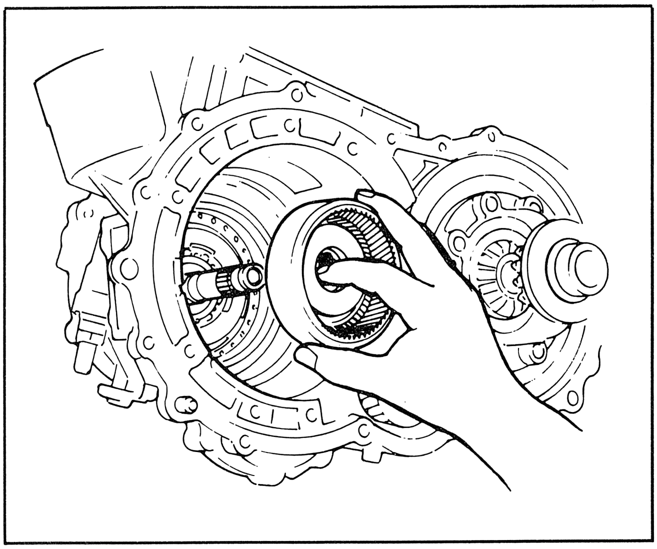


Figure 7A1-173 Installing Rear Planetary Ring Gear

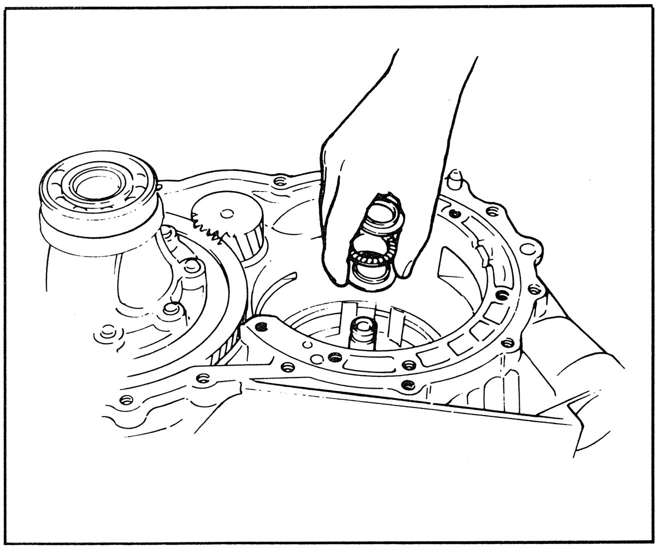


Figure 7A1-174 Installing Rear Planetary Ring Gear Races and Bearing

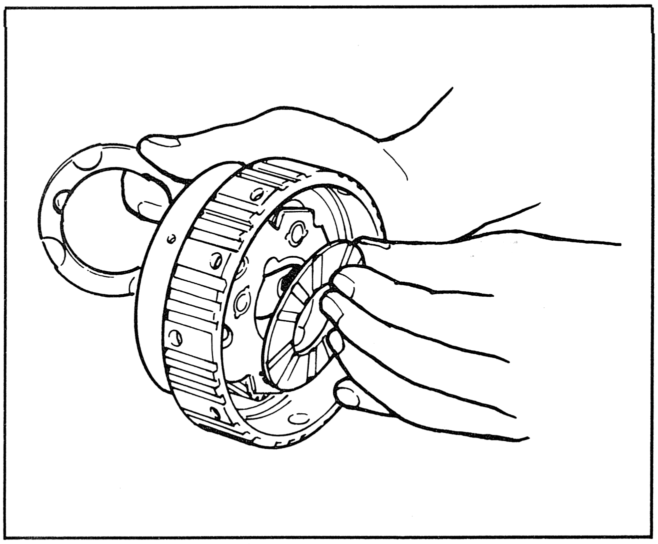


Figure 7A1-175 Installing Rear Planetary Thrust Washers

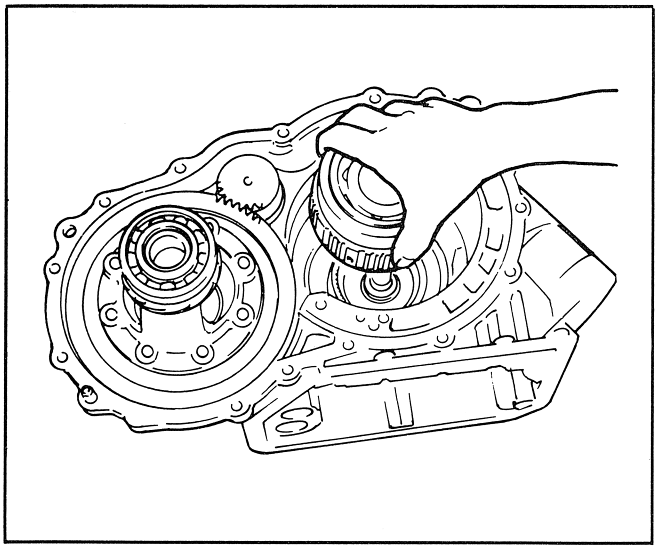


Figure 7A1-176 Installing Rear Planetary Gear Assembly

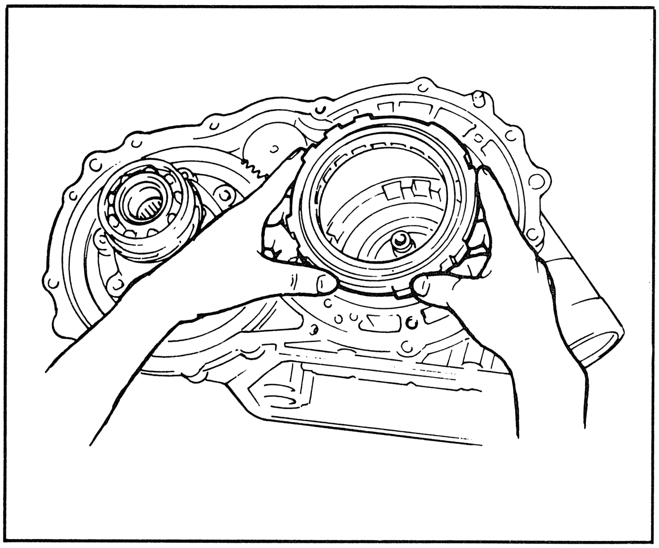
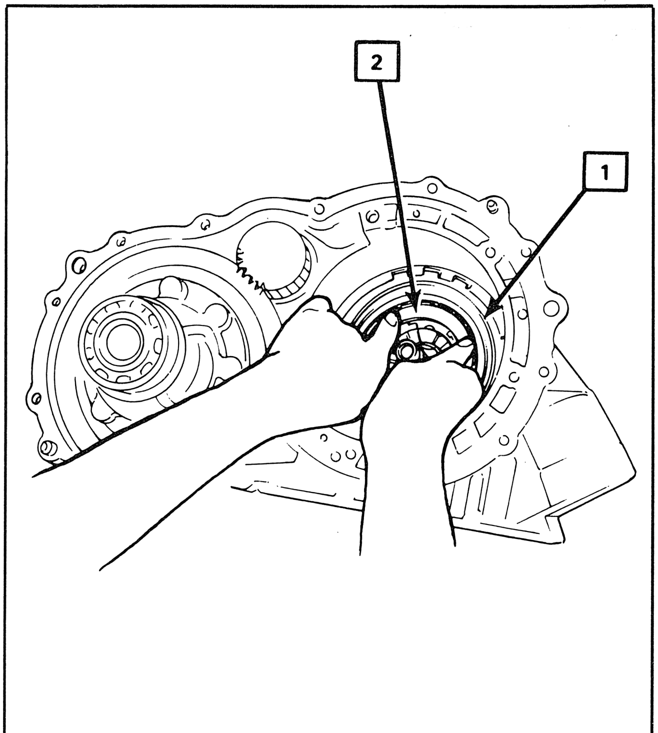


Figure 7A1-177 Installing One-Way Clutch



1. ONE-WAY CLUTCH
2. REAR PLANETARY GEAR ASSEMBLY

ROTATION: CLOCKWISE FREELY
COUNTER CLOCKWISE → LOCKED

Figure 7A1-178 Checking Rear Planetary Gear Rotation

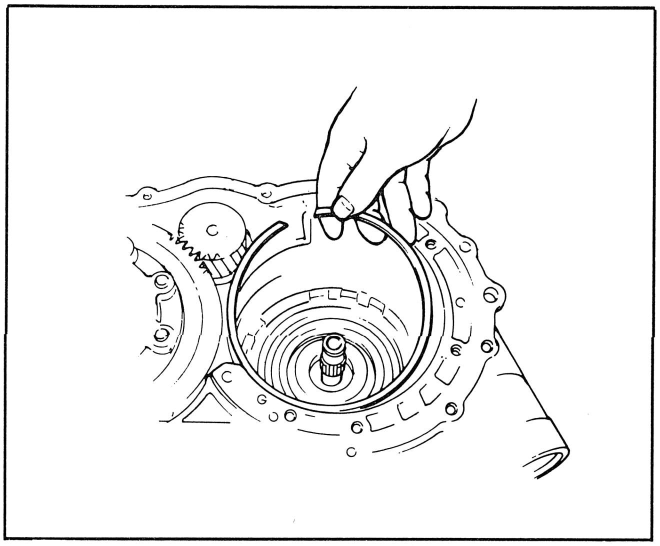


Figure 7A1-179 Installing One-Way Clutch Race Snap Ring

29. Direct clutch washer on the direct clutch. Apply grease to the washer and install it on the direct clutch with its grooved face outward.
30. Direct clutch on the input shaft. Align teeth of the direct clutch discs and then install direct clutch on the input shaft. After installing direct clutch, check it for proper installation by moving it up and down lightly by hand. If the direct clutch makes a clear sound like a "Click" when moved up and down, it is installed in place. But if no sound or a "Click" is heard, it is possible that direct clutch is not installed correctly. In such a case, remove direct clutch and reinstall.
31. Ring gear races and bearing. Apply grease to the ring gear races and bearing. Install ring gear race (OD: 35.8 mm, 1.41 in.) on the ring gear with its flange side down. Install the other ring gear race (OD: 37.9 mm, 1.49 in.) and bearing. See Figure 7A1-159 for proper installation.
32. Input shaft and forward/direct clutch assembly. Hold the input shaft with direct clutch installed by hand and while turning it back and forth, insert it into the case. Align teeth of the forward clutch discs before installation. When installing the input shaft, be careful so that its bearing and race will not fall off. Be careful not to damage the output shaft seal. After installing input shaft, check it for proper installation by moving it up and down lightly by hand. If input shaft makes clear sound like a "Click" when moved up and down, it is installed in place. But if it doesn't, that means it is not installed in proper position. In such a case, remove the assembly and reinstall.
33. Check for correct installation of each component part as follows. After installing input shaft, check

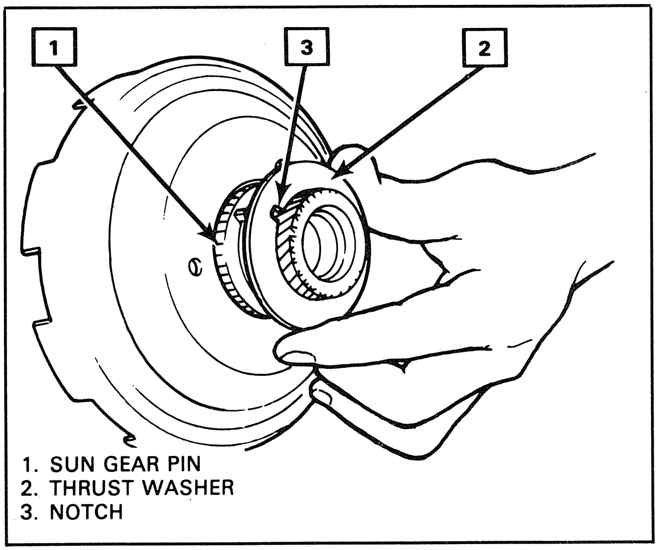


Figure 7A1-180 Sun Gear Pin and Thrust Washer

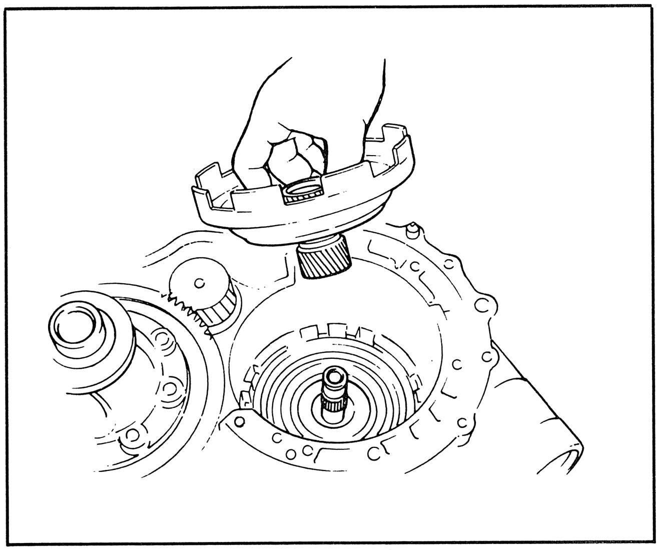


Figure 7A1-181 Installing Sun Gear Assembly

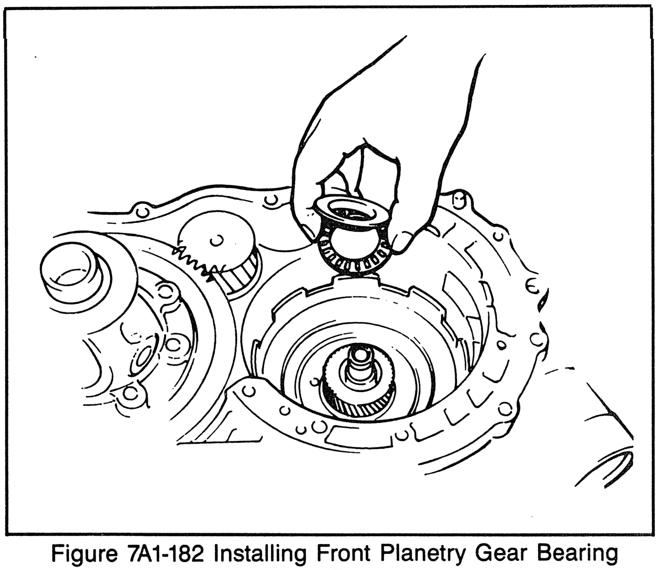


Figure 7A1-182 Installing Front Planetry Gear Bearing and Race

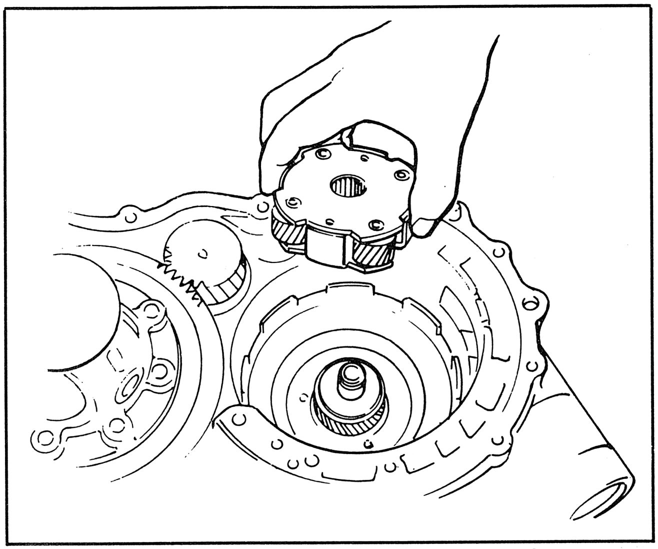


Figure 7A1-183 Installing Front Planetary Gear Assembly

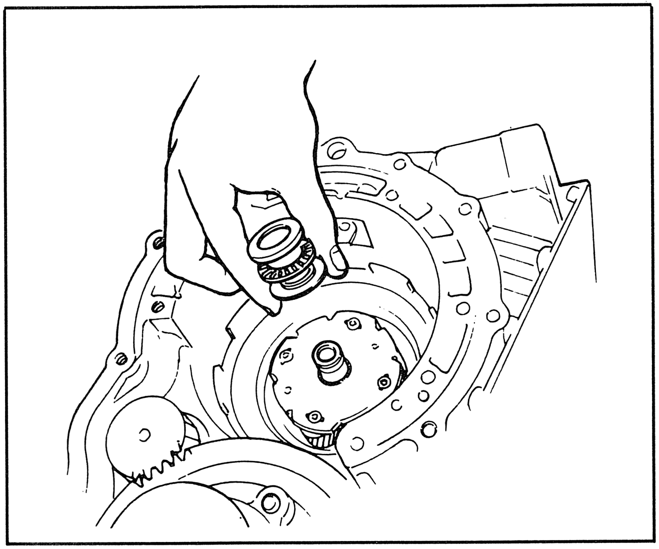


Figure 7A1-184 Installing Ring Gear Races and Bearing

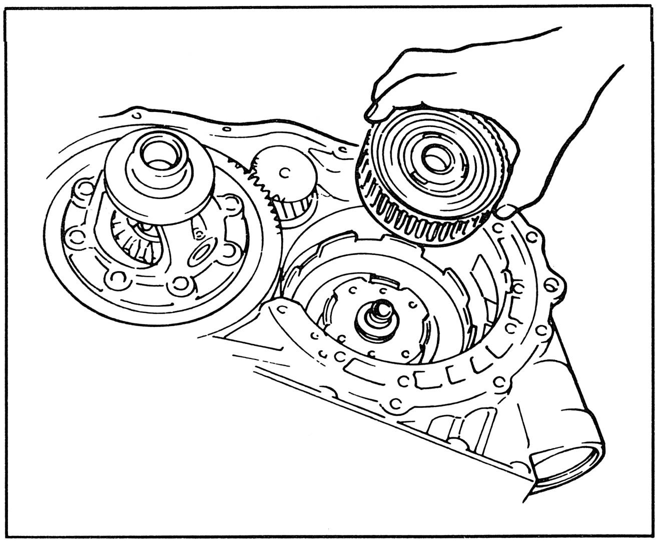


Figure 7A1-185 Installing Front Planetary Ring Gear Assembly

to make sure that each component is installed properly according to the following description.

Place a steel straightedge (J-34673) on the transaxle case end surface as shown in Figure

1. SECOND BRAKE BAND
2. PIN
3. PISTON COVER SNAP RING
4. PISTON COVER
5. COVER SEAL
6. RETAINER
7. SEAL RING
8. SECOND BRAKE PISTON
9. PISTON SEAL
10. PISTON SPRING
11. BRAKE ROD SPRING
12. WASHER
13. PISTON ROD SEAL
14. SECOND BRAKE PISTON ROD
15. COVER GASKET
16. COVER

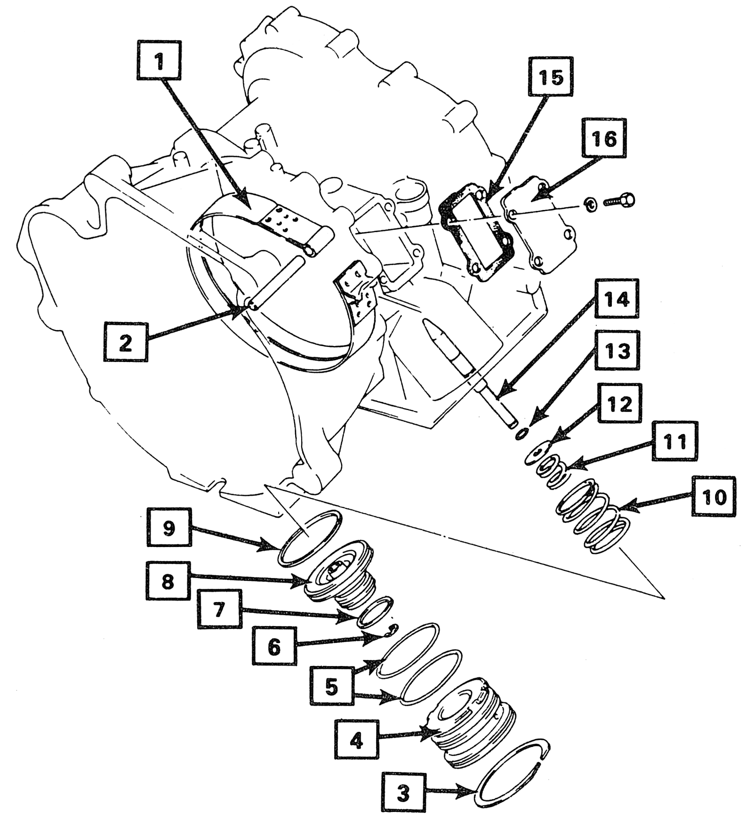


Figure 7A1-186 Second Brake Components

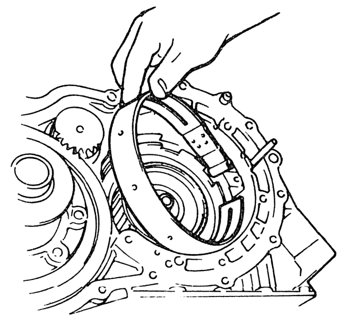


Figure 7A1-87 Installing Second Brake Band

7A1-198 and measure the distance (A) shown, by using a Depth Micrometer (J-34672) or Vernier. For the distance (A), subtract the width of straightedge from Depth Micrometer or Vernier reading. If measured distance (A) is within following specification, it means that component parts other than direct clutch are installed properly. If out of specification, disassemble component parts and reinstall them properly.

34. Second Brake Band Pin. Align the hole in second brake band with the case pin hole and insert brake band pin. Apply Automatic Transmission Fluid to the brake band pin before installation.
35. Case gasket and transaxle case housing. Use new gasket. Install gasket using care so that it will not protrude inside.

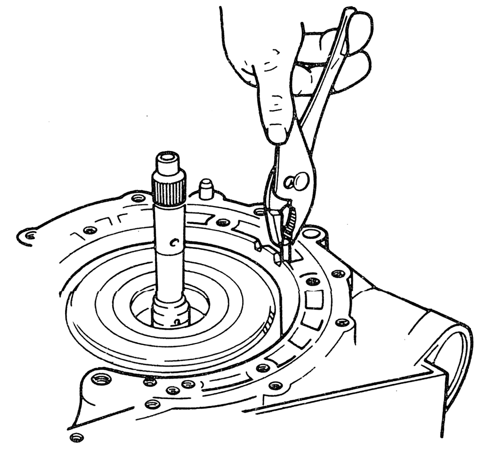


Figure 7A1-188 Installing Second Brake Band Pin

36. Among the fourteen (14) case housing bolts, three (3) bolts have starshaped grooves in their head. Install these three (3) bolts in the positions as shown by (A) in Figure 7A1-200 after applying sealant to their threads. Do not apply thread locking compound to the other housing bolts. Tighten case housing bolts to specification.
37. Input shaft bearing race and bearing on the forward clutch. Grease the bearing race and install it with its flange side outward together with the bearing.
Install so that the bearing does not get on bearing race flange.

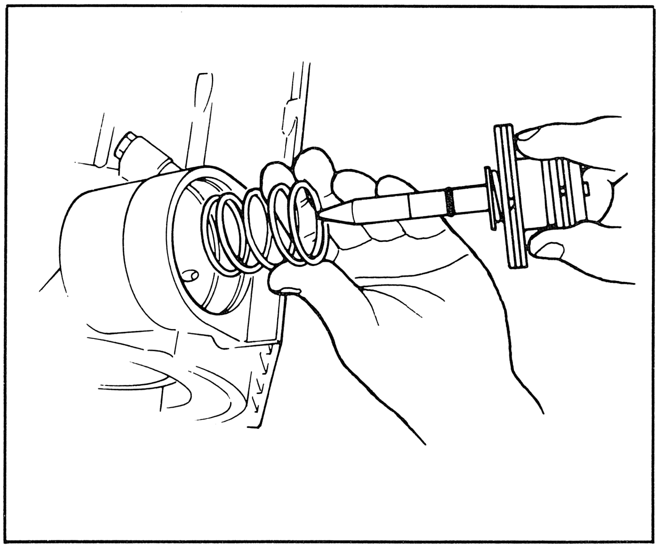


Figure 7A1-189 2nd Brake Piston Spring and Piston

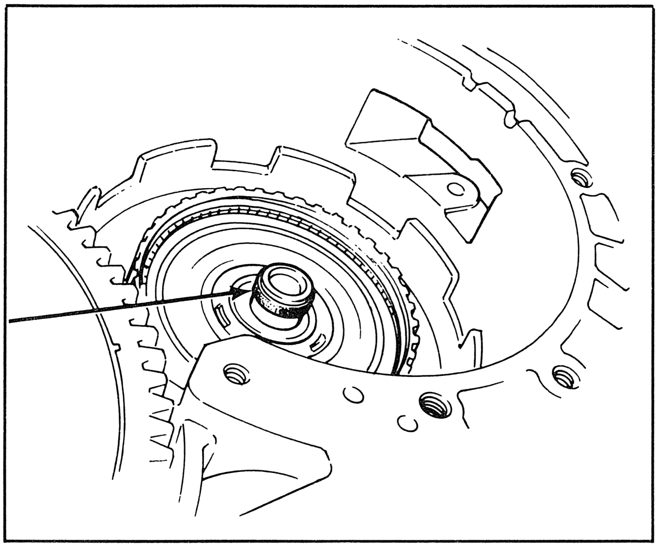


Figure 7A1-192 Output Shaft Seal Ring

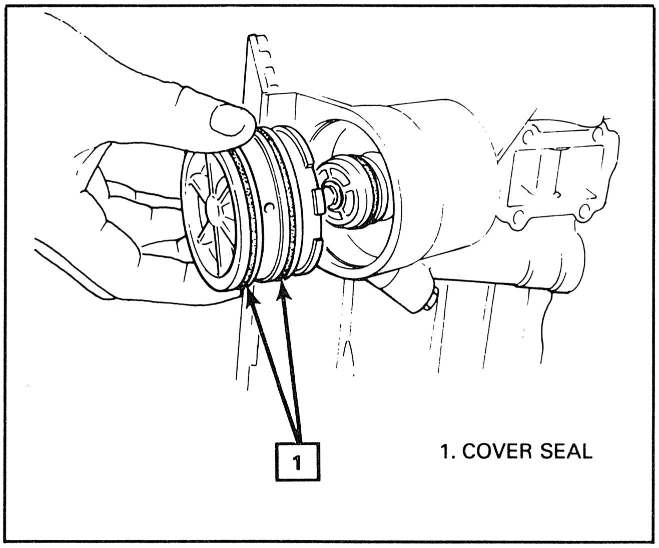

1
1. COVER SEAL

Figure 7A1-190 Installing Piston Cover

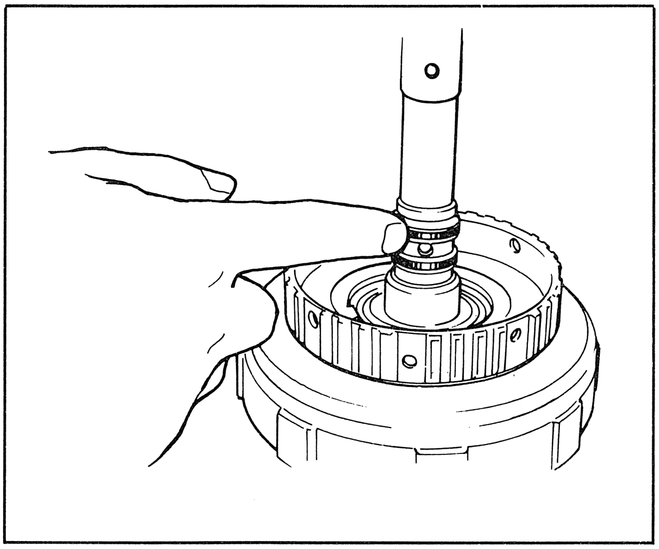


Figure 7A1-193 Input Shaft Seal Rings

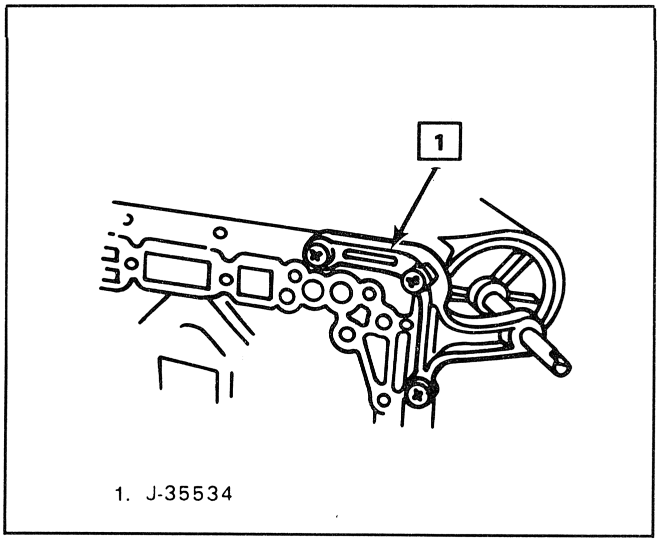


Figure 7A1-191 Using J35534

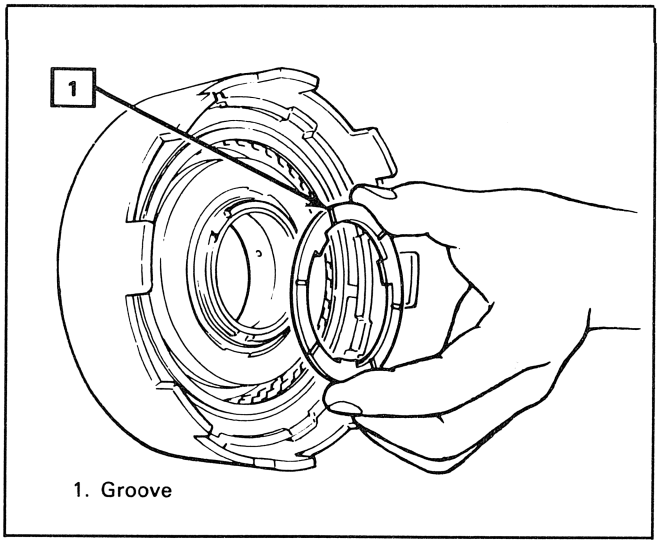


Figure 7A1-194 Installing Direct Clutch Washer

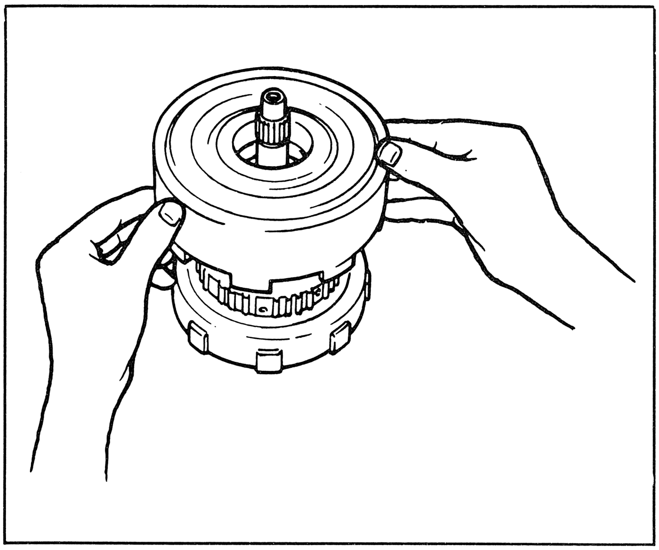
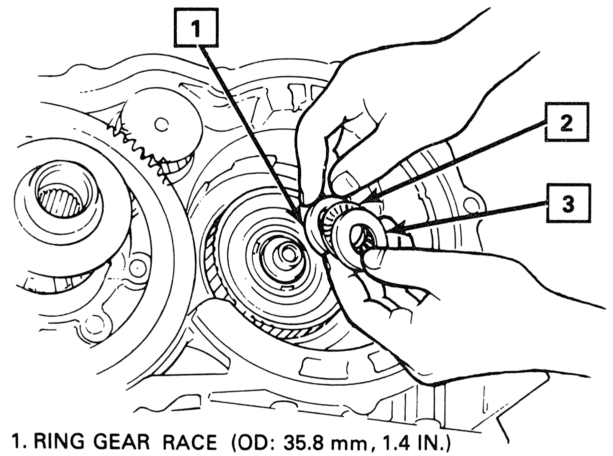


Figure 7A1-195 Installing Direct Clutch



1. RING GEAR RACE (OD: 35.8 mm, 1.4 IN.)
2. BEARING
3. RING GEAR RACE (OD: 37.9 mm, 1.49 IN.)

Figure 7A1-196 Installing Ring Gear Races and Bearing

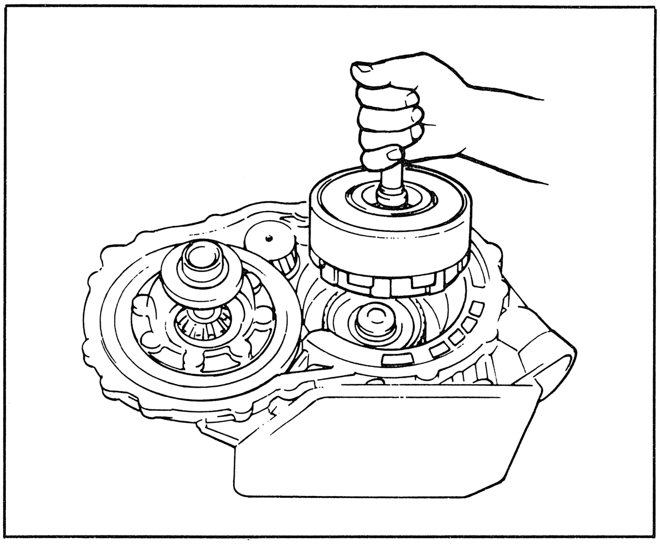
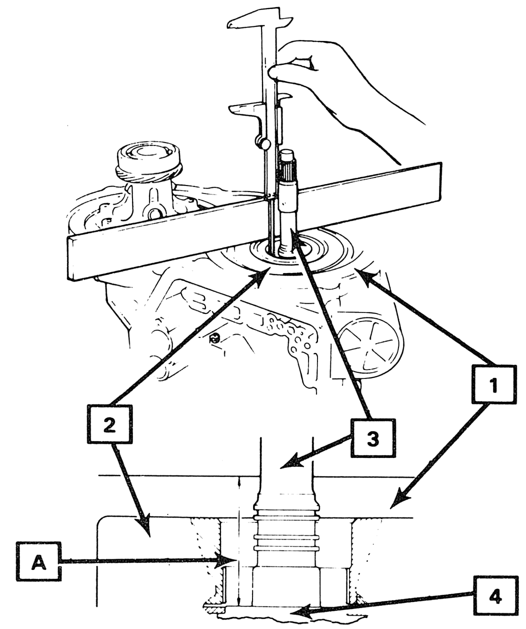


Figure 7A1-197 Installing Input Shaft



1. TRANSAXLE CASE END SURFACE
2. DIRECT CLUTCH DRUM
3. INPUT SHAFT
4. INPUT SHAFT FLANGE
Ⓐ: 49.82-51.06mm
(1.962-2.010in.)

Figure 7A1-198 Measuring Distance Between Case End Surface and Input Shaft Flange

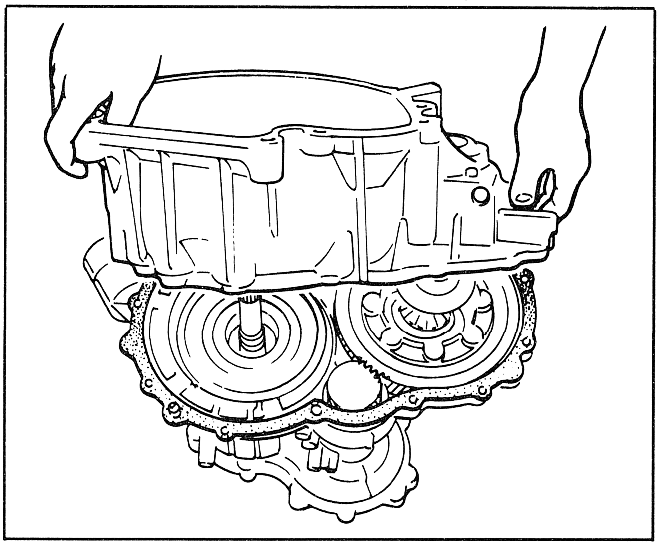


Figure 7A1-199 Installing Gasket and Case Housing

38. The other input shaft bearing race on the oil pump. Grease bearing race and attach it to the oil pump body.
39. Direct clutch washer on the oil pump. Attach greased washer on the oil pump. Fit washer flange into notch of the oil pump body.
40. New oil pump cover seal ("O" ring) to oil the pump. Install greased cover seal on the outer groove of the oil pump. Make sure that cover seal is not twisted or extruded.
41. Oil pump to transaxle case. Align oil pump bolt holes with case bolt holes and push down on the

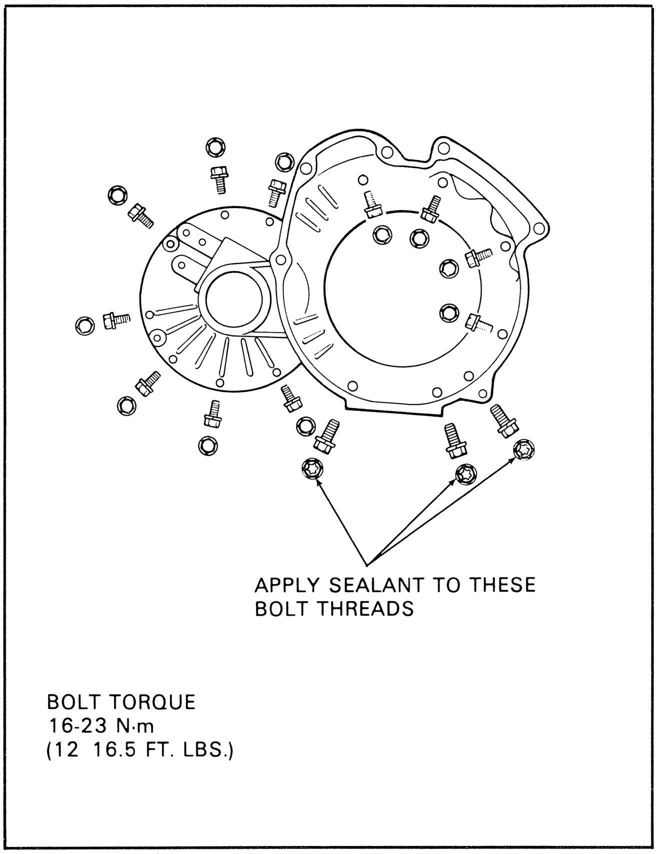


Figure 7A1-200 Case Housing Bolts Installation

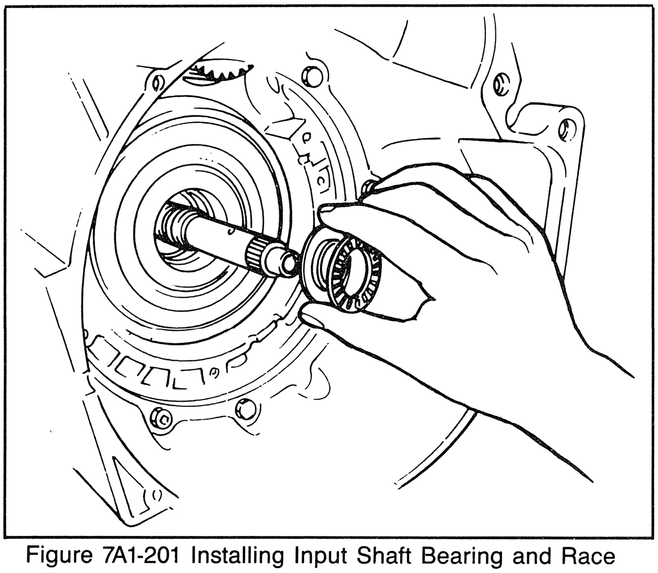


Figure 7A1-201 Installing Input Shaft Bearing and Race

pump gently by hand until it contacts case. Use care so that direct clutch washer does not fall off, and the input shaft seal rings and pump cover seal rings will not come off or get damaged. Tighten six (6) oil pump bolts gradually to specification.

42. Check input shaft end play. Position a dial indicator (J-8001) onto the input shaft end surface and measure the thrust play of the input shaft, 0.3 - 0.9 mm (0.012 - 0.035) (Figure 7A1-205). If out of specification, remove oil pump and replace input shaft bearing race on the oil pump side (See Figure 7A1-202).

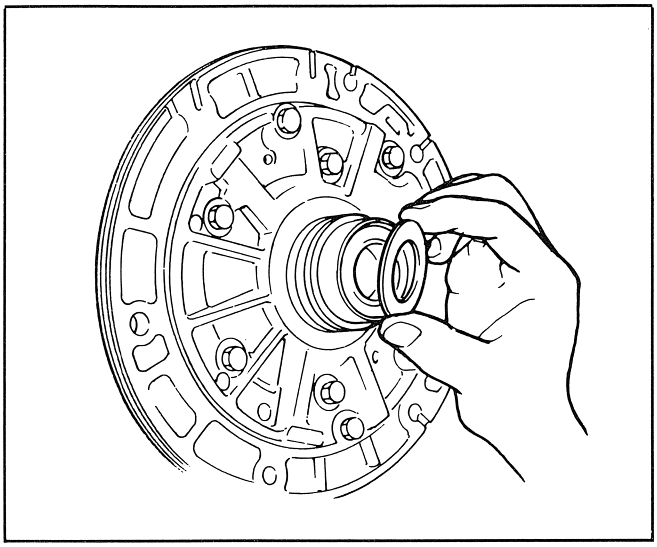


Figure 7A1-202 Installing Input Shaft Bearing Race On Oil Pump

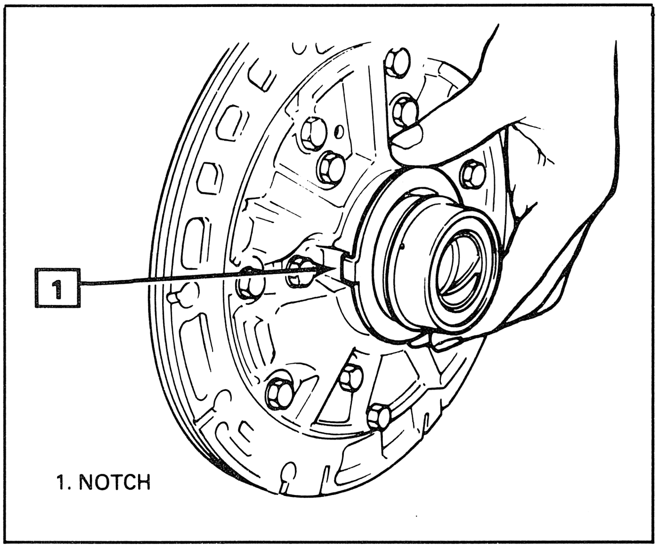


Figure 7A1-203 Installing Direct Clutch Washer

43. Solenoid wire harness to case (Figure 7A1-206).
    a. Insert solenoid wire holding plate in the groove in the solenoid wire grommet and install solenoid wire to stud bolt of transaxle case (Figure 7A1-207).
    b. Secure holding plate with a lock washer and nut.
    c. Install (two) 2 solenoid wire clamps to rear cover. Secure them with rear cover bolts.
44. Check for the correct installation of second brake band. Looking through the second brake band cover hole, check that the second brake piston rod end is aligned with the center of recess in the brake band as shown in Figure 7A1-208. If rod end contacts outside of the brake band recess, pull up second brake band by inserting thin wire in brake band fitting so that the band recess aligns with rod end properly.
45. Check second brake piston stroke as previously described. For checking procedure, see Figure 7A1-78 and 7A1-79.
46. Install second brake band cover with new gasket.

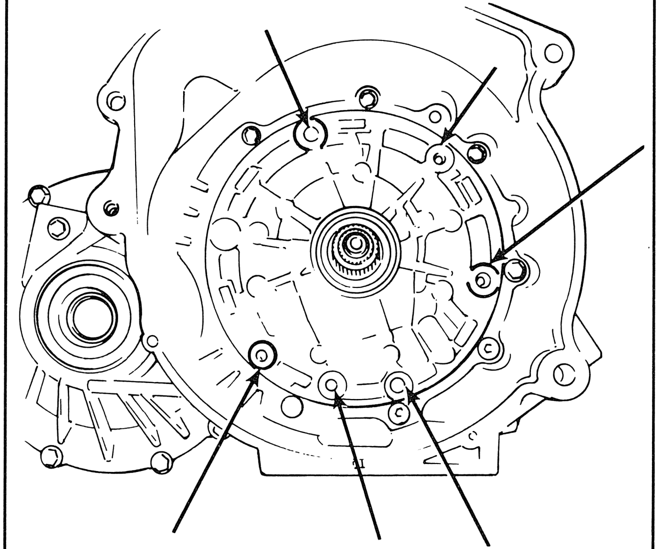

BOLT TORQUE
18-27 N·m
(13.5 19.5 FT. LBS.)

Figure 7A1-204 Installing Oil Pump

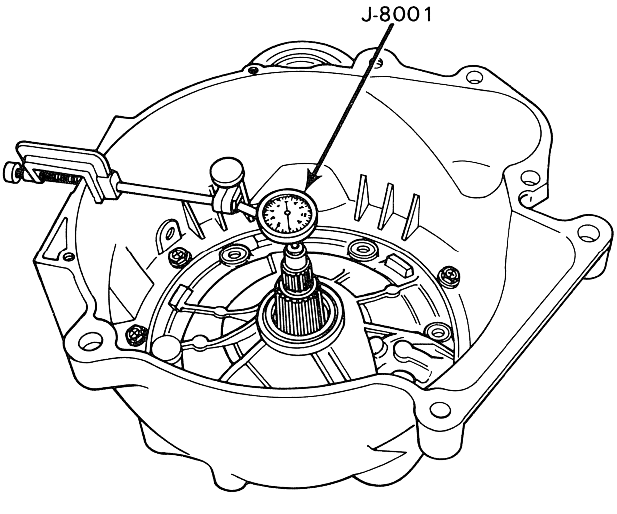

J-8001
INPUT SHAFT END PLAY
0.3 - 0.9mm (0.012-0.035 in.)
BEARING RACE THICKNESS
0.8mm (0.031 in.)
1.4mm (0.055 in.)

Figure 7A1-205 Measuring Thrust Play of Input Shaft

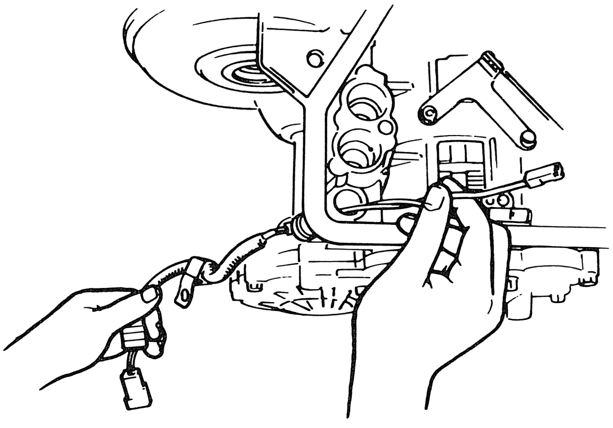


Figure 7A1-206 Installing Solenoid Wire Harness

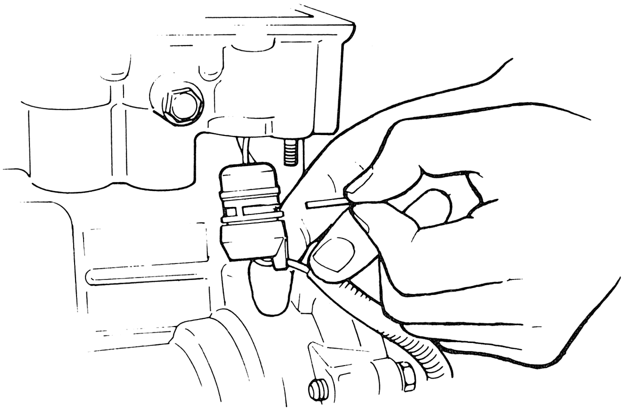


Figure 7A1-207 Installing Solenoid Wire Hold Plate

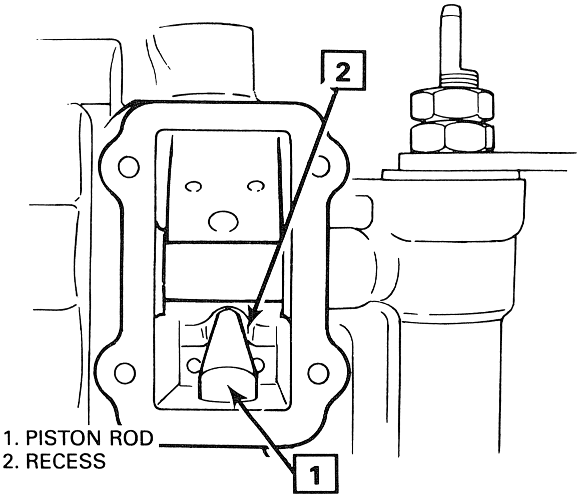

2
1
1. PISTON ROD
2. RECESS

Figure 7A1-208 Second Brake Piston Rod and Brake Band Recess

47. Oil pressure control cable in case.

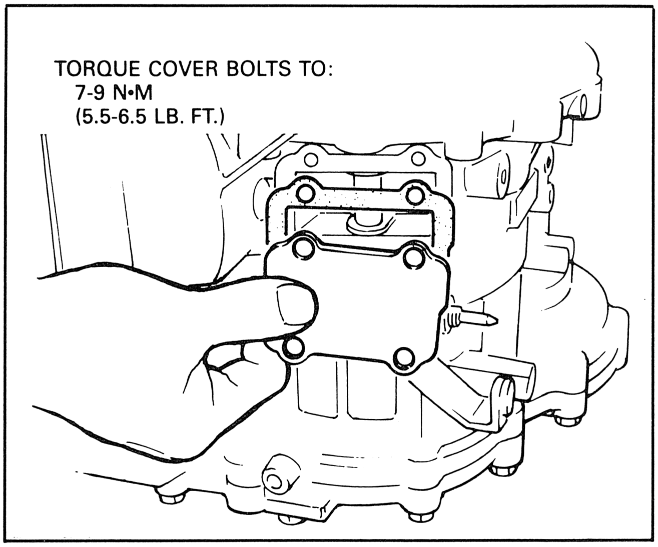

TORQUE COVER BOLTS TO:
7-9 N•M
(5.5-6.5 LB. FT.)

Figure 7A1-209 Installing Second Brake Cover

48. Accumulator pistons and spring as shown in Figure 7A1-210.
    a. Install new seal rings on pistons. Be sure to apply Automatic Transmission Fluid to pistons and seal rings.
    b. Install pistons in the case. Be careful so that seal rings will not fall off.
    c. Insert spring into the second brake accumulator piston.

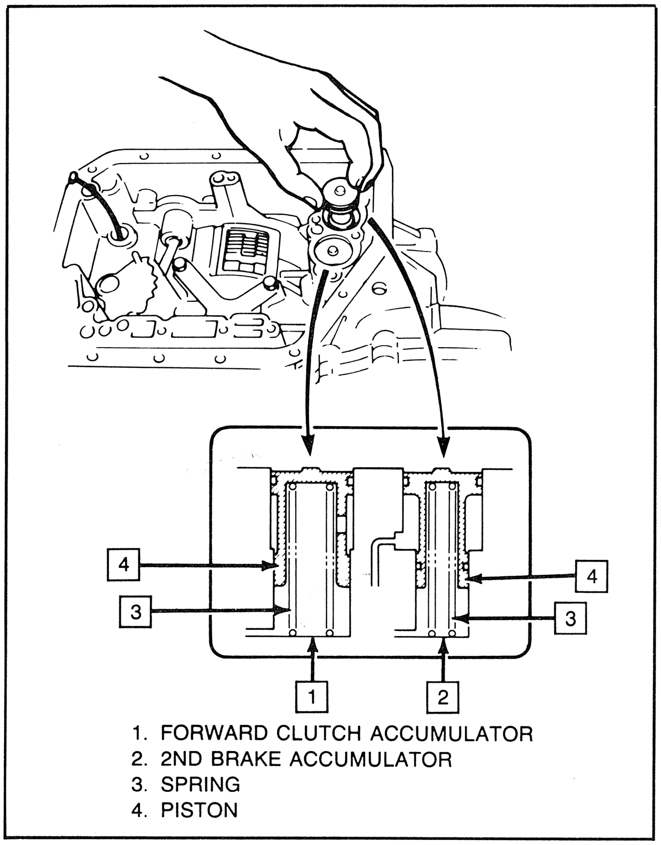

4
3
4
3
1
2
1. FORWARD CLUTCH ACCUMULATOR
2. 2ND BRAKE ACCUMULATOR
3. SPRING
4. PISTON

Figure 7A1-210 Installing Accumulator Pistons and Spring

49. Lower valve body to case. Align manual valve with the pin on the manual shift lever and lower the valve body into place. Be careful so that accumulator spring will not incline. Install eleven (11) bolts in lower valve body. First, tighten two reamer bolts (positioning bolts) "A" and "B" lightly. Then tighten all bolts in diagonal order.

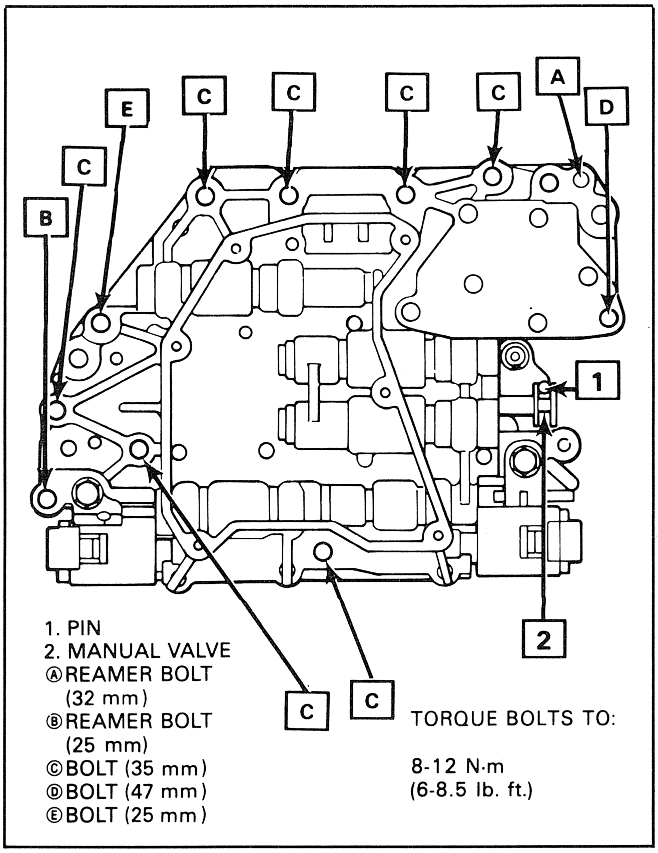

E
C
C
C
C
A
D
C
B
1
2
C
C
1. PIN
2. MANUAL VALVE
Ⓐ REAMER BOLT (32 mm)
Ⓑ REAMER BOLT (25 mm)
Ⓒ BOLT (35 mm)
Ⓓ BOLT (47 mm)
Ⓔ BOLT (25 mm)
TORQUE BOLTS TO:
8-12 N·m
(6-8.5 lb. ft.)

Figure 7A1-211 Installing Lower Valve Body

50. Install oil pressure control cable on the throttle valve cam. While holding cam down with your fingers, slide cable end into slot.

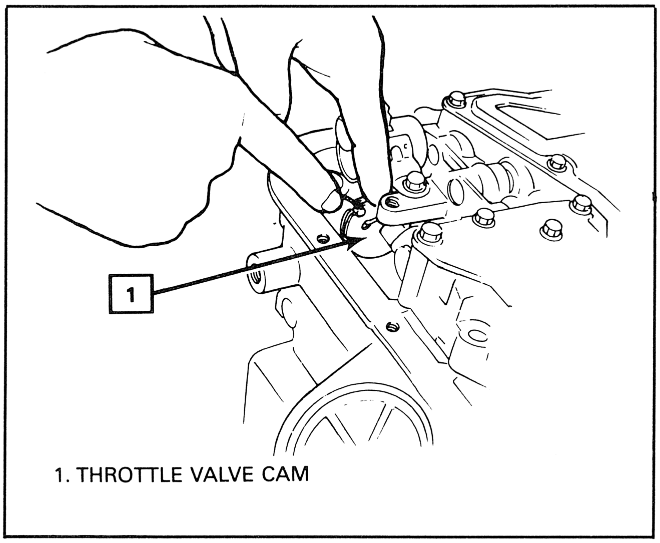

1
1. THROTTLE VALVE CAM

Figure 7A1-212 Installing Oil Pressure Control Cable to Throttle Valve Cam

51. Oil tubes to lower valve body. First put the end of the oil tube without the flange about 2mm (0. 08 in.) into lower valve body, then insert the one

with the flange and push both ends of tube by hand. Next, tap them lightly with a plastic hammer as far as flange position.

- Do not deform tubes when installing.
- Install them horizontally to valve body.
- Make sure to insert them up to flange position securely.

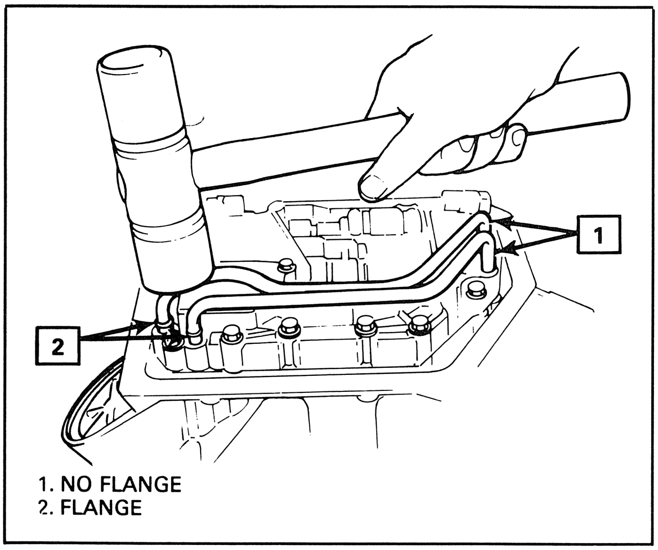

1
2
1. NO FLANGE
2. FLANGE

Figure 7A1-213 Installing Oil Tubes

52. Two (2) solenoid wires; one to the direct clutch solenoid and the other to the second brake solenoid.

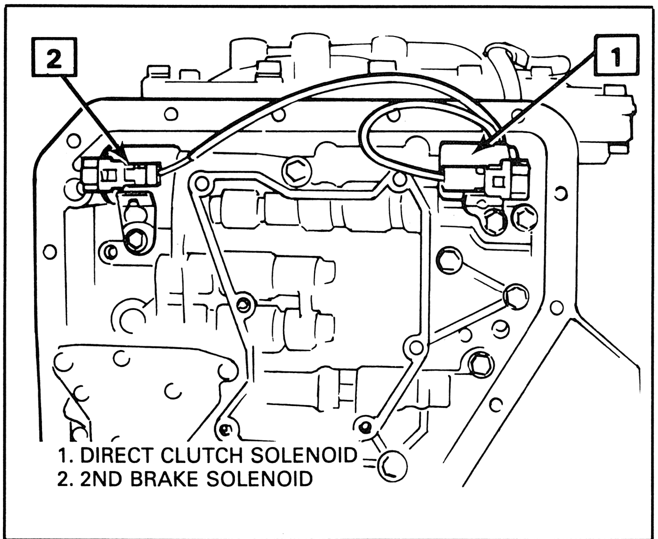

2
1
1. DIRECT CLUTCH SOLENOID
2. 2ND BRAKE SOLENOID

Figure 7A1-214 Connecting Solenoid Wires

53. Oil strainer and solenoid wire clamp. Retain the solenoid wire by fastening solenoid wire clamp with oil strainer bolt in the position as shown in Figure 7A1-215.
54. Magnet in oil pan and oil pan with new gasket.
    a. Install magnet in oil pan right under oil strainer as shown in Figure 7A1-216.
    b. Check to make sure that oil tubes are not in contact with oil pan.
    c. There are fifthteen (15) oil pan bolts in all and two of them have cross grooves in their head. Install these two cross grooved bolts in the positions as shown in Figure 7A1-217 after applying sealant to their threads. Tighten fifthteen (15) oil pan bolts to specification.

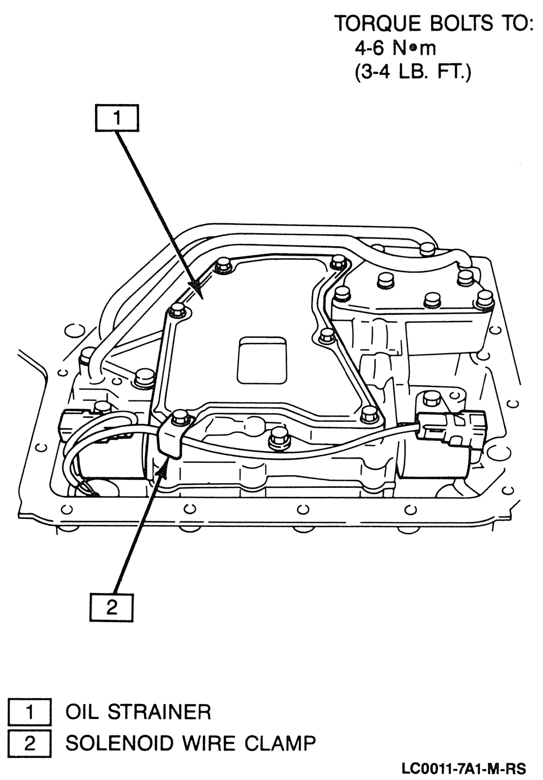

TORQUE BOLTS TO:
4-6 N•m
(3-4 LB. FT.)
1
2
1 OIL STRAINER
2 SOLENOID WIRE CLAMP
LC0011-7A1-M-RS

Figure 7A1-215 Installing Oil Strainer

    d. Tighten oil pan drain plug to specification.

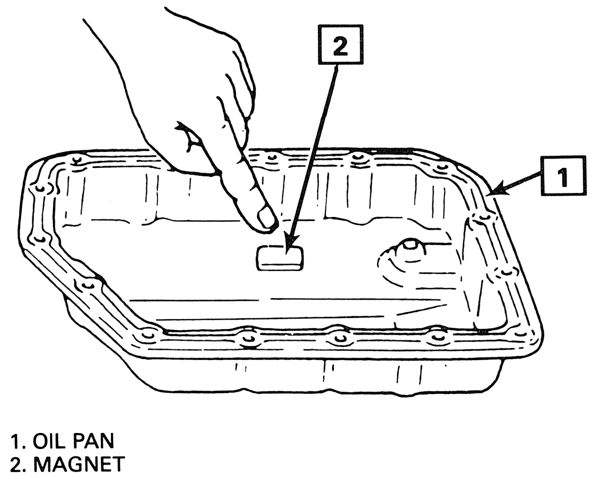
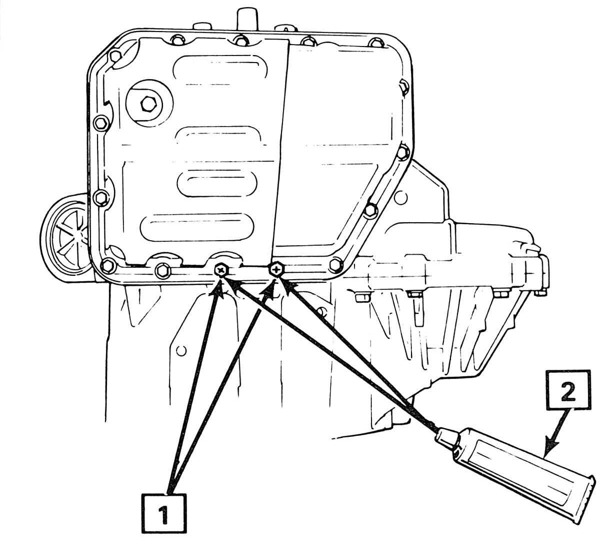

2
1
1. OIL PAN
2. MAGNET

Figure 7A1-216 Installing Magnet in Oil Pan

55. New differential oil seals to the case and housing as shown in Figure 7A1-218.

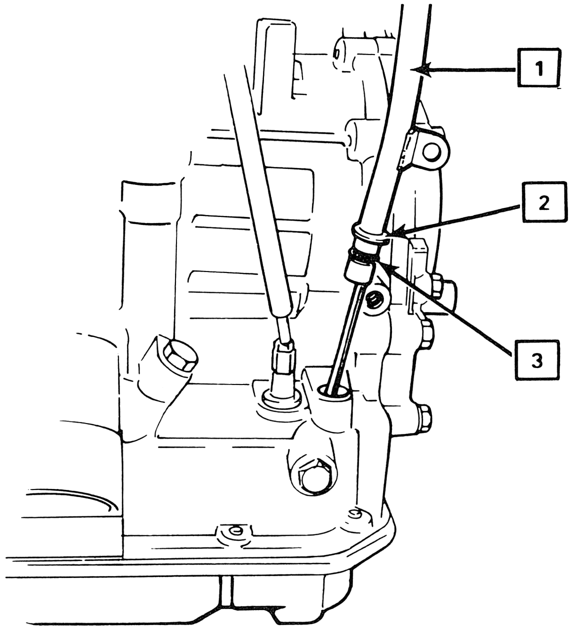
56. Oil filler tube with a new "O" ring. Insert oil filler tube in case as far as its flange and tighten with bolt.



OIL PAN BOLTS:
4-6 N•M
(3-4 LB. FT.)
OIL DRAIN PLUG
18-23 N•M
(13.5-16.5 LB. FT.)

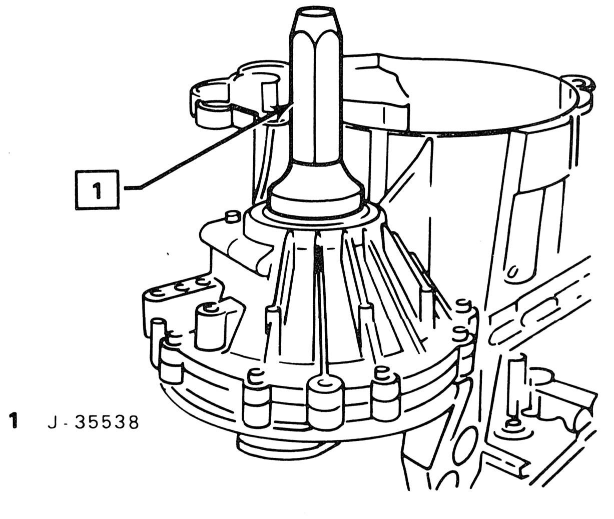
1. CROSSED GROOVED BOLTS
2. SEALANT

Figure 7A1-217 Installing Oil Pan Bolts



OIL FILLER TUBE BOLT TORQUE
4-6 N•M
(3-4 LB. FT.)
1. OIL FILLER TUBE
2. FLANGE
3. "O" RING

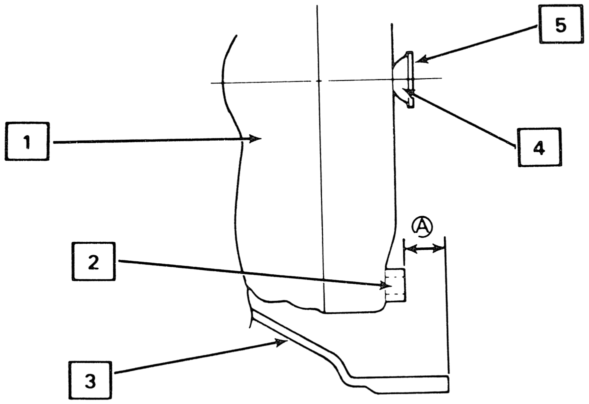
Figure 7A1-219 Installing Oil Filler Tube



1 J-35538

Figure 7A1-218 Using J-35538

57. Torque converter to input shaft.
    a. Install torque converter, using care not to damage oil seal of oil pump.
    b. After installing torque converter, measure distance (A) shown in Figure 7A1-220. The distance should be more than 21.4 mm (0.85 in.). If it is less than 21.4 mm (0.85 in.), it means that the torque converter is improperly installed. Therefore, in such case, remove the torque converter, and then, reinstall it for proper installation.
    c. Check torque converter for smooth rotation.
    d. Apply grease around the cup at center of torque converter.



1. TORQUE CONVERTER
2. FLANGE NUT
3. TRANSAXLE CASE HOUSING
4. CUP
5. APPLY GREASE HERE

Ⓐ: MORE THAN 21.4 MM (0.85 IN.)

Figure 7A1-220 Torque Converter Installation

Tightening bolt or nut	N·m	Ft. Lbs.
Transaxle case housing bolts	16 - 23	12.0 - 16.5
Rear cover case bolts	16 - 23	12.0 - 16.5
Rear cover case nuts	11 - 15	8.0 - 10.5
Oil pump case bolts	18 - 27	13.5 - 19.5
Oil pump cover bolts	8 - 12	6.0 - 8.5
2nd brake band cover bolts	7 - 9	5.5 - 6.5
Reduction driven gear nut	110 - 150	80.0 - 108.0
Manual shift lever nuts	27 - 33	20.0 - 23.5
Manual detent spring bolt & nut	8 - 12	6.0 - 8.5
Lower valve body bolts	8 - 12	6.0 - 8.5
Upper valve body bolts	5 - 6	3.7 - 4.0
Oil strainer bolts	5 - 6	3.7 - 4.0
Solenoid bolt	7 - 9	5.5 - 6.5
Throttle valve cam bolt	6 - 9	4.5 - 6.5
Oil pan bolts	4 - 6	3.0 - 4.0
Oil drain plug	18 - 23	13.5 - 16.5
Drive plate bolts (8 mm) *To install drive plate to torque converter	18 - 19	13.0 - 14.0
Drive rear plate bolts (10 mm) *To install drive plate and drive rear plate to crankshaft	56 - 62	40.5 - 45.0
Lower valve body cover bolt	4 - 6	3.0 - 4.0

Lube capacity (approximately)

- ● Pan removal .... 1.5 liters (3.16/2.64 US/Imp. Pts.)
- ● Overhaul without torque converter .... 3.5 liters (3.7/3.1 US/Imp. Qts.)
- ● Overhaul with new torque converter .... 4.9 liters (5.2/4.3 US/Imp. Qts.)

Lube recommended .... Dexron II Automatic Transmission Fluid

LC0012-7A1-M-RS

Figure 7A1-SP Specifications

1.	J-6125-B	OIL PUMP PULLER SLIDE HAMMERS
2.	J-7079-2	DRIVER HANDLE
3.	J-8001	DIAL INDICATOR SET
4.	J-8092	DRIVER HANDLE
5.	J-9617	OIL PUMP SEAL INSTALLER
6.	J-22888	OUTPUT SHAFT BEARING PULLER
7	J-23327	CLUTCH SPRING COMPRESSOR
8.	J-23907	SLIDE HAMMER
9.	J-25018-A	CLUTCH SPRING COMPRESSOR ADAPTER
10.	J-28509	DIFFERENTIAL BEARING PULLER
11.	J-29369-1	COUNTERSHAFT BALL BEARING REMOVER
12.	J-29369-2	COUNTERSHAFT ROLLER BEARING REMOVER
13.	J-34672	DEPTH MICROMETER
14.	J-34673	FLAT GAUGE BAR
15.	J-34842	DIFFERENTIAL SIDE BEARING INSTALLER
16.	J-34851	DIFFERENTIAL SIDE BEARING PILOT
17.	J-35495	OIL PUMP PULLER ADAPTERS
18.	J-35525	HOLDING FIXTURE
19.	J-35534	PISTON COVER DEPRESSOR
20.	J-35537	COUNTERSHAFT BEARING INSTALLER
21.	J-35538	DIFFERENTIAL OIL SEAL INSTALLER
22.	J-35539	OUTPUT SHAFT REMOVER/INSTALLER
23.	J-35608	COUNTERSHAFT INSTALLER

Figure 7A1-ST Special Tools

SECTION 7B

MANUAL TRANSAXLE

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GENERAL DESCRIPTION

CONSTRUCTION AND SERVICING

Figures 1 and 2

The transmission provides five forward speeds and one reverse speed by means of three sychronizers and three shafts: input shaft, countershaft in constant mesh with input shaft, and a reverse shaft which uses a sliding idler gear arrangement (Figures 1 and 2).

The low speed synchronizer is mounted on the counter shaft and will engage with either the counter shaft first gear or second gear. The high speed synchronizer is mounted on input shaft and will engage with either the input shaft third gear or fourth gear.

The fifth speed synchronizer is mounted on input shaft and is engaged with the input shaft fifth gear.

The countershaft turns the ring gear and differential assembly, thereby turning the front drive axles which are attached to the front wheels.

For servicing, it is necessary to use genuine sealant or its equivalent on mating surfaces of transmission case which is made of aluminum. The case fastening bolts must be tightened to specified torque by means of torque wrench. It is also important that all parts are thoroughly cleaned with cleaning fluid and air dried before reassembling.

Further, care must be taken to adjust preload of counter shaft taper roller bearings.

GEAR SHIFT MECHANISM

Figure 3

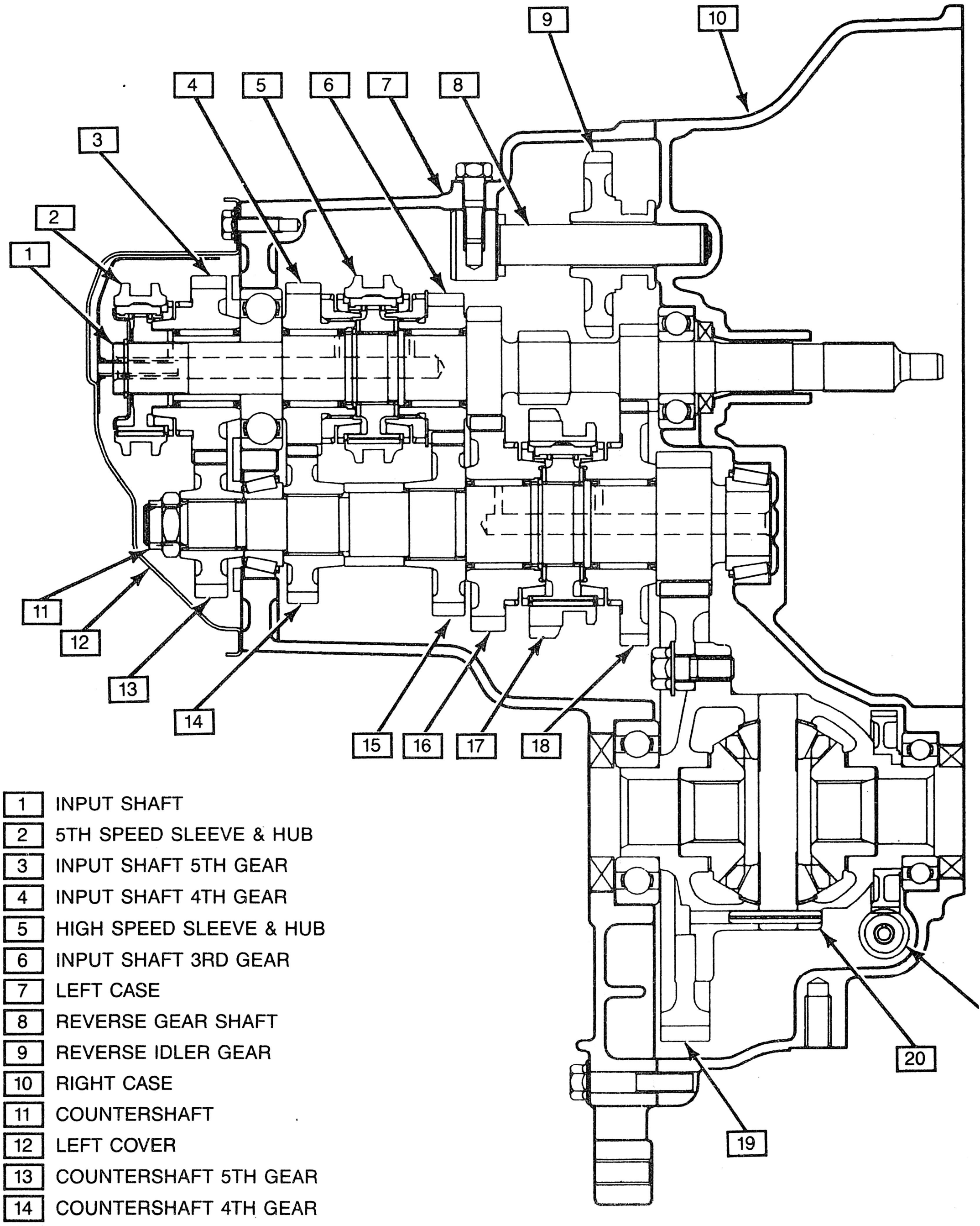
Movement of the gear shift control lever is transmitted to the gear shift shaft through gear shift control shaft, and gear shift/select shaft through the gear shift arm and shift yoke. The gear shift/select shaft actuates the shift/select lever which actuates each shift fork shaft and shift fork to shift transaxle into the desired gear. The gear shift interlock plate is provided to prevent the transaxle from engaging into two gears while shifting.

5TH AND REVERSE GEAR SHIFT CAM

Figures 4 through 8

The fifth gear/reverse gear shift cam along with the cam quide return spring and fifth to reverse interlock guide bolt are provided to prevent the gear shift lever from being directly shifted from fifth gear to reverse gear.

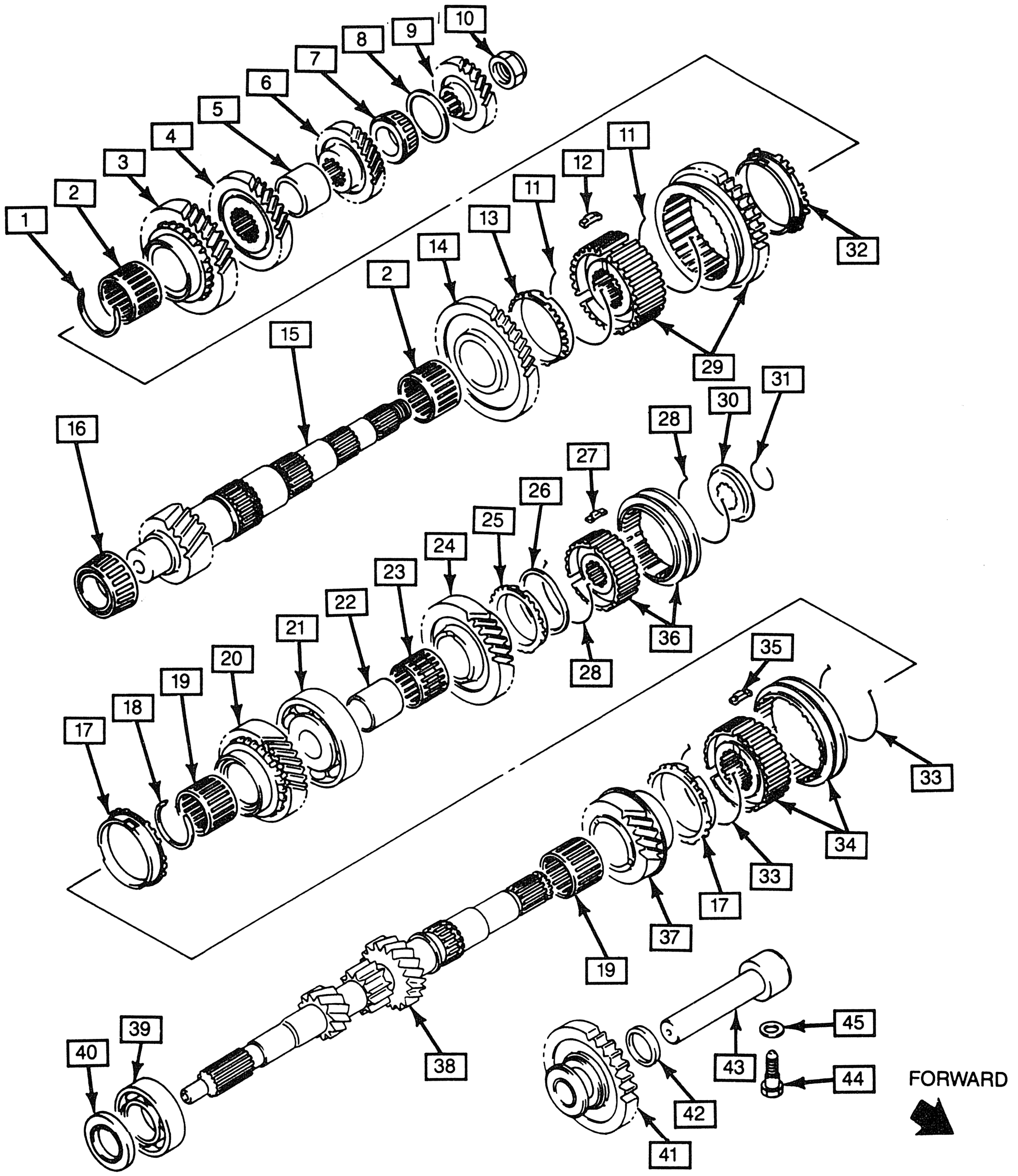
1. When the gear shift lever is shifted to "fifth" gear, the fifth and reverse gear shift cam turns clockwise with gear shift/select shaft. It is pushed up by the cam guide return spring to the position where the interlock guide bolt prevents the cam from being shifted directly from "fifth gear to reverse" (Figure 5).
2. Shifting from "fifth" to "neutral" is available and further shift to reverse is interrupted. However, when shift/select shaft is moved to neutral of "third" - "fourth" position, the shift limit cam mechanism is cancelled (Figure 6).
3. The selected position in neutral of "fifth" - "REV" is shown in (Figure 7). The shift/select shaft moves up to allow shift/select lever to shift in "fifth" or "reverse" position. The shift cam remains in position because of interference from the guide bolt (Figure 7).
4. Now the shifter is ready to be shifted to "reverse" without interference of the shift cam (Figure 8).



1	INPUT SHAFT
2	5TH SPEED SLEEVE & HUB
3	INPUT SHAFT 5TH GEAR
4	INPUT SHAFT 4TH GEAR
5	HIGH SPEED SLEEVE & HUB
6	INPUT SHAFT 3RD GEAR
7	LEFT CASE
8	REVERSE GEAR SHAFT
9	REVERSE IDLER GEAR
10	RIGHT CASE
11	COUNTERSHAFT
12	LEFT COVER
13	COUNTERSHAFT 5TH GEAR
14	COUNTERSHAFT 4TH GEAR
15	COUNTERSHAFT 3RD GEAR
16	COUNTERSHAFT 2ND GEAR
17	LOW SPEED SLEEVE & HUB
18	COUNTERSHAFT 1ST GEAR
19	FINAL GEAR
20	DIFFERENTIAL CASE
21	SPEEDOMETER DRIVEN GEAR

KC1208-7B-M-RS

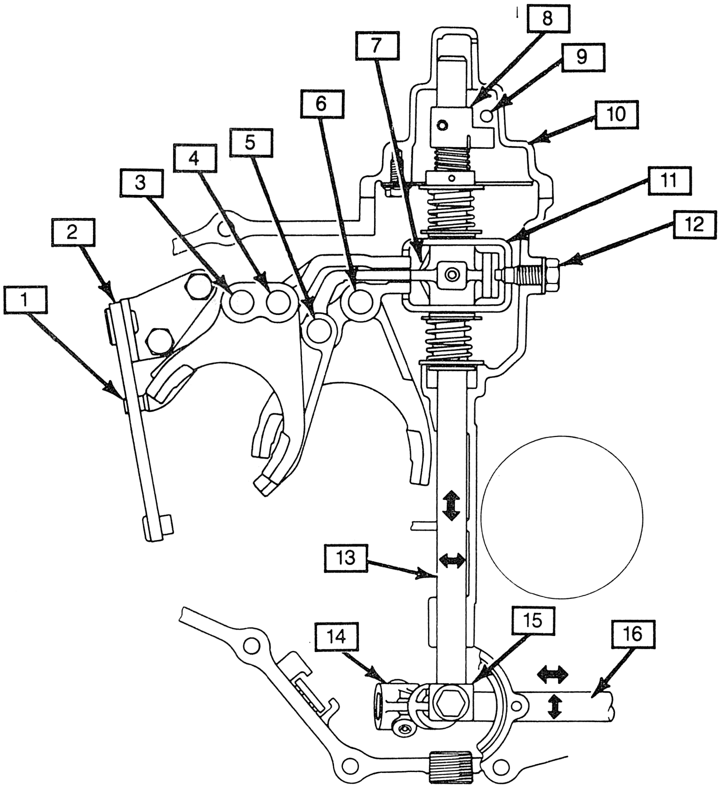
Figure 1 Manual Transaxle Cutaway



1	SNAP RING
2	1ST & 2ND GEAR BEARING
3	COUNTERSHAFT 2ND GEAR
4	COUNTERSHAFT 3RD GEAR
5	3RD & 4TH GEAR SPACER
6	COUNTERSHAFT 4TH GEAR
7	COUNTERSHAFT LH. BEARING
8	BEARING SET SHIM
9	COUNTERSHAFT 5TH GEAR
10	COUNTERSHAFT NUT
11	LOW SPEED SYNCHRONIZER SPRING
12	LOW SPEED SYNCHRONIZER KEY
13	1ST GEAR SYNCHRONIZER RING
14	COUNTERSHAFT 1ST GEAR
15	COUNTERSHAFT
16	COUNTERSHAFT RH. BEARING
17	HIGH SPEED SYNCHRONIZER RING
18	SNAP RING
19	3RD & 4TH GEAR BEARING
20	INPUT SHAFT 4TH GEAR
21	INPUT SHAFT LH. BEARING
22	5TH GEAR SPACER
23	5TH GEAR BEARING
24	INPUT SHAFT 5TH GEAR
25	5TH SPEED SYNCHRONIZER RING
26	SYNCHRONIZER RING SPRING
27	5TH SYNCHRONIZER KEY
28	5TH SYNCHRONIZER SPRING
29	LOW SPEED SLEEVE & HUB
30	5TH SYNCHRONIZER HUB PLATE
31	SNAP RING
32	2ND GEAR SYNCHRONIZER RING
33	HIGH SPEED SYNCHRONIZER SPRING
34	HIGH SPEED SLEEVE & HUB
35	HIGH SPEED SYNCHRONIZER KEY
36	5TH SPEED SLEEVE & HUB
37	INPUT SHAFT 3RD GEAR
38	INPUT SHAFT
39	INPUT SHAFT RH. BEARING
40	OIL SEAL
41	REVERSE IDLER GEAR
42	REVERSE SHAFT WASHER
43	REVERSE GEAR SHAFT
44	REVERSE SHAFT BOLT
45	WASHER

KC1209-7B-M-RS

Figure 2 Manual Transaxle Exploded View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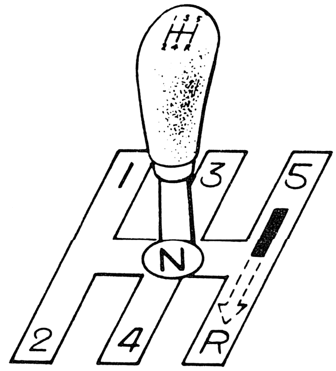
KC1210-7B-M-RS

1	REVERSE GEAR SHIFT ARM
2	REVERSE GEAR SHIFT LEVER
3	5TH & REV GEAR SHIFT GUIDE SHAFT
4	5TH & REV GEAR SHIFT SHAFT
5	HIGH SPEED GEAR SHIFT SHAFT
6	LOW SPEED GEAR SHAFT
7	GEAR SHIFT & SELECT LEVER
8	5TH & REV GEAR SHIFT CAM
9	5TH & REV INTERLOCK GUIDE BOLT
10	GEAR SHIFT GUIDE CASE
11	GEAR SHIFT INTERLOCK PLATE
12	GEAR SHIFT INTERLOCK BOLT
13	GEAR SHIFT & SELECT SHAFT
14	GEAR SHIFT ARM
15	GEAR SHIFT YOKE
16	GEAR SHIFT SHAFT

Figure 3 Gear Shifting Mechanism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N
2
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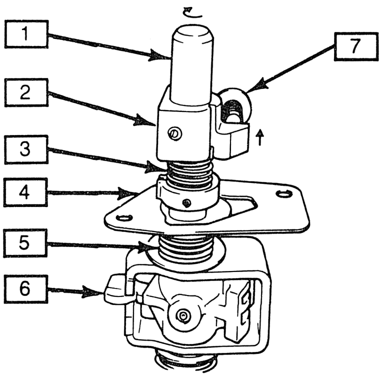
R
KC1211-7B-M-RS

Figure 4 Gear Shifting Pattern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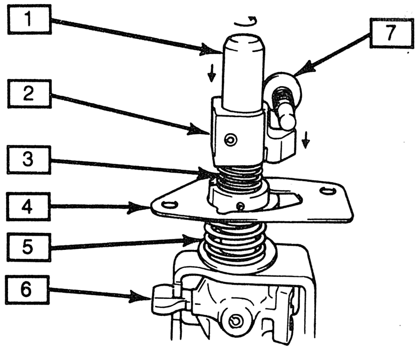
7
KC1212-7B-M-RS

1	GEAR SHIFT & SELECT SHAFT
2	5TH & REV GEAR SHIFT CAM
3	CAM GUIDE RETURN SPRING (EXPANDED)
4	GEAR SHIFT GUIDE CASE PLATE
5	REV SELECT SPRING (COMPRESSED)
6	GEAR SHIFT & SELECT LEVER (IN 5TH POSITION)
7	5TH TO REV INTERLOCK GUIDE BOLT

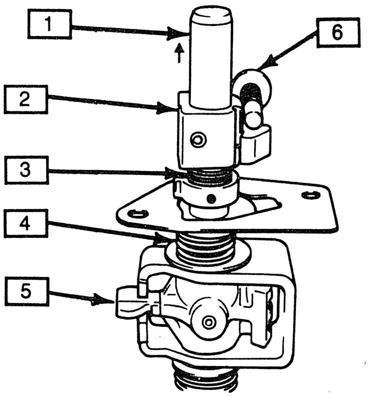
Figure 5 5th Gear



1 SHIFT & SELECT SHAFT
2 SHIFT CAM
3 RETURN SPRING (EXPANDED)
4 CASE PLATE
5 REV SELECT SPRING (EXPANDED)
6 SHIFT & SELECT LEVER (N OF 3RD–4TH POSITION)
7 GUIDE BOLT

KC1213-7B-M-RS

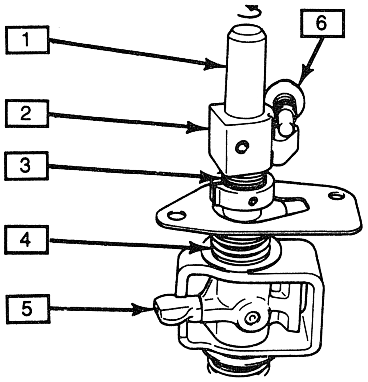
Figure 6 3rd - 4th Position



1 SHIFT & SELECT SHAFT
2 SHIFT CAM
3 RETURN SPRING (COMPRESSED)
4 REV SELECT SPRING (COMPRESSED)
5 SHIFT & SELECT LEVER (N OF 5TH–REV POSITION)
6 GUIDE BOLT

KC1214-7B-M-RS

Figure 7 5th - Reverse Position



1 SHIFT & SELECT SHAFT
2 SHIFT CAM
3 RETURN SPRING (COMPRESSED)
4 REV SELECT SPRING (COMPRESSED)
5 SHIFT & SELECT LEVER (IN REV POSITION)
6 GUIDE BOLT

KC1215-7B-M-RS

Figure 8 Reverse Gear

DIAGNOSIS

CONDITION	POSSIBLE CAUSE	CORRECTION
Shift lever slips out of gear	Worn shift fork shaft	Replace
	Worn shift fork or synchronizer sleeve	Replace
	Weak or damaged locating springs	Replace
	Worn bearings on input shaft or countershaft	Replace
	Worn chamfered tooth on sleeve or gear	Replace sleeve or gear
Hard shifting	Inadequate lubricant	Replenish
	Improper clutch pedal free travel	Adjust
	Distorted or broken clutch disc	Replace
	Damaged clutch pressure plate	Replace clutch cover
	Worn synchronizer ring	Replace
	Worn chamfered tooth on sleeve or gear	Replace sleeve or gear
	Worn gear shift control shaft joint bushing	Replace
	Distorted shift shaft	Replace
Noise	Inadequate or insufficient lubricant	Replenish
	Damaged or worn bearing(s)	Replace
	Damaged or worn gear(s)	Replace
	Damaged or worn synchronzier parts	Replace

ON-VEHICLE SERVICE

TRANSAXLE OIL LEVEL

Figure 9

Before checking oil level, check the transaxle for oil leakage. If leakage is found, repair it.

1. With the engine stopped, remove the oil level/filler plug from transaxle (Figure 9).
2. Check to see that oil level reaches the fill hole. If oil level is low fill the transaxle with oil recommended in MAINTENANCE AND LUBRICATION (Section OB).
3. Install oil level/filler plug.

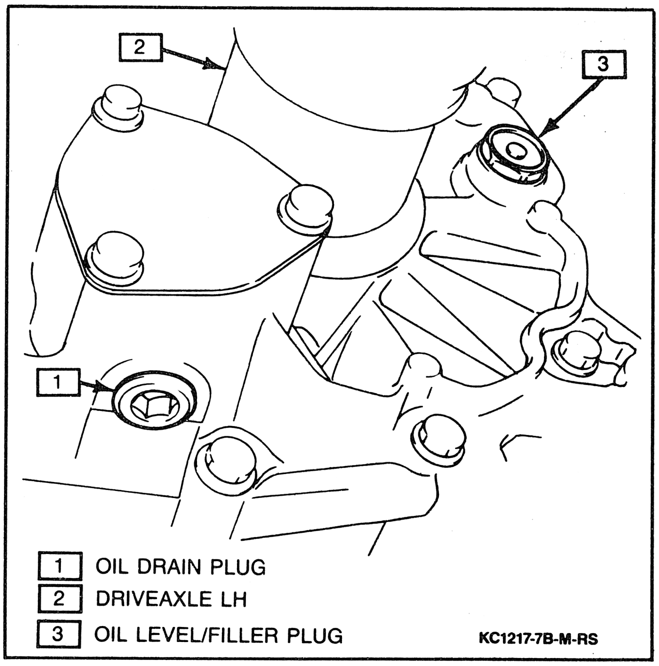

1 OIL DRAIN PLUG
2 DRIVEAXLE LH
3 OIL LEVEL/FILLER PLUG
KC1217-7B-M-RS

Figure 9 Transaxle Oil Fill and Drain Plugs

Tighten

- Oil level/filler plug to 45 N·m (33 lb.ft.).

TRANSAXLE OIL CHANGE

Figure 9

Before changing oil, check the transaxle for oil leakage. If leakage is found, repair it.

1. With the engine stopped, remove the oil level/filler plug (Figure 9).
2. Using a 10mm socket, remove the drain plug and drain oil.
3. After draining, install drain plug.

NOTICE: Before installing drain plug, clean the thread portion of the plug and then apply sealant #1052080 or equivalent to the threaded portion.

Tighten

- Drain plug to 28 N·m (21 lb.ft.).

4. Refill the transaxle with new oil recommended in MAINTENANCE AND LUBRICATION (Section 0B).
5. Install oil level/filler plug.

Tighten

- Oil level/filler plug to 45 N·m (33 lb.ft.).

DIFFERENTIAL SIDE OIL SEAL

Figures 10, 11, and 12

Remove or Disconnect

1. Hoist vehicle and drain transaxle oil.
2. Drive axle so as to release snap ring fitting of joint spline at differential side (Figure 10).
3. Ball joint bolt and nut, and separate suspension arm from knuckle (Figure 11).

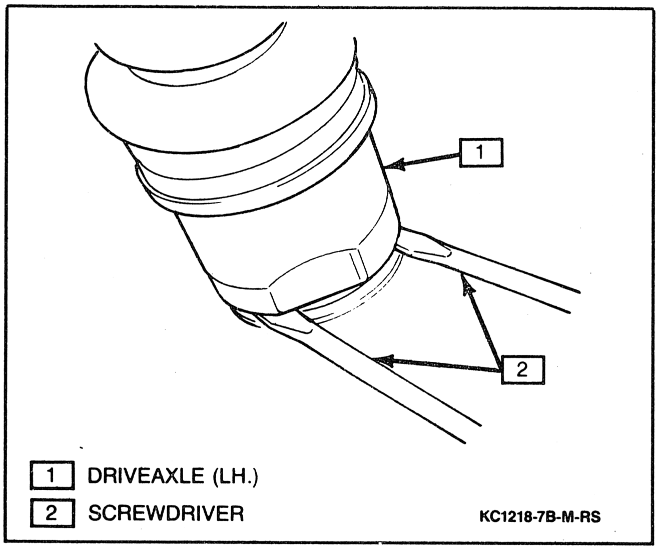

1 DRIVEAXLE (LH.)
2 SCREWDRIVER
KC1218-7B-M-RS

Figure 10 Removing Left Drive Axle

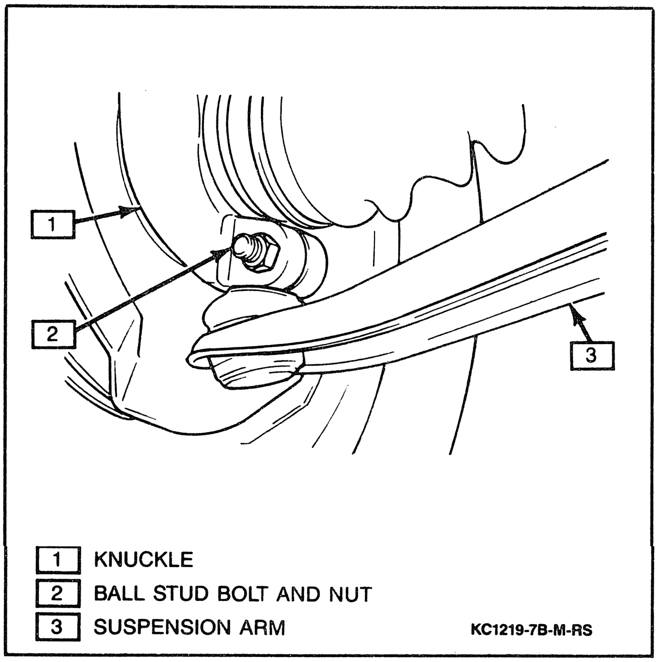

1 KNUCKLE
2 BALL STUD BOLT AND NUT
3 SUSPENSION ARM
KC1219-7B-M-RS

Figure 11 Suspension Arm/Knuckle Removal

4. Drive axle at differential side by pushing knuckle portion outward.
5. Oil seal.

Install or Connect

1. New oil seal until it becomes flush with case surface using J29130 with J8092 and hammer (Figure 12).

NOTICE:

- Apply grease to oil seal lip and at same time check drive axle where oil seal contacts and make sure of its smoothness.
- When installing oil seal, place spring side inward.

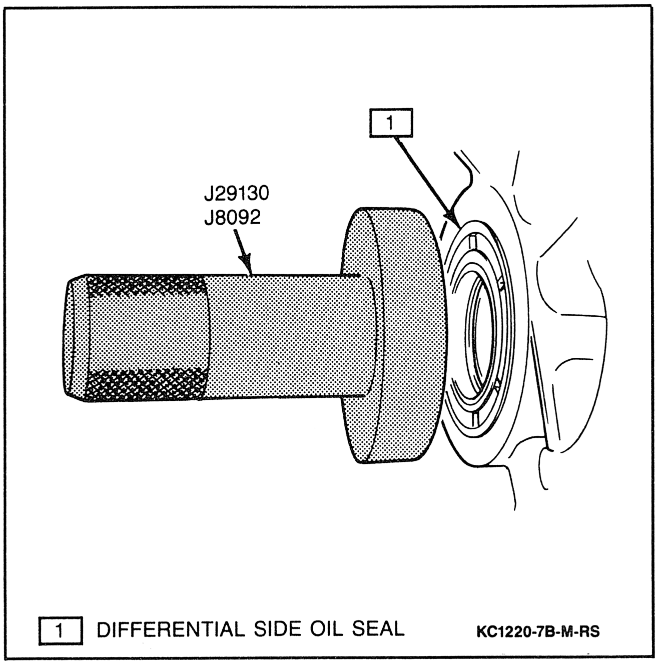


Figure 12 Side Differential Oil Seal Installation

2. Drive axle to differential side.
3. Ball stud with knuckle and fasten with bolt to specification.

NOTICE:

- Be careful not to scratch oil seal lip with drive axle while inserting.
- Make sure to insert drive axle fully and seat its snap ring.
- Do not hit axle boot with hammer or a similar tool. Use only bare hands when inserting axle.

Tighten

- Ball joint bolt and nut to 60 N·m (44 lb.ft.).

4. Fill transaxle.

GEAR SHIFT CONTROL

Figures 13 through 17

Remove or Disconnect

1. Hoist vehicle.
2. Gear shift control shaft from gear shift control lever by removing control shaft bolt and nut (Figure 14).
3. Four guide plate bolts and loosen extension rod nut at transaxle end then move extension rod to the side (Figure 14).
4. Lower vehicle.
5. Two screws from shift control lever cover (if equipped with cover).
6. Four control lever housing nuts and push shift control lever boot(s) into floor hole. Take out shift control lever assembly from under the floor.
7. Hold control lever knob with a soft jawed vise, loosen its screw and remove control lever (Figure 15).
8. Two housing nuts, then disassemble control lever (Figure 15).

Install or Connect

1. Assembly control lever and install two housing nuts (Figure 16).
2. Control lever and its screw. If necessary, use soft jawed vise to hold control lever knob.
3. Shift control lever assembly into floor, and pull shift control lever boot(s) up from the floor and install four control lever housing bolts and nuts.
4. Two screws into shift control lever cover (if equipped with cover).
5. Raise vehicle.
6. Reposition extension rod and tighten extension rod nut.
7. Four guide plate bolts.

Adjust

- Control lever assembly to correct position.

Tighten

- Control lever housing nuts to 4.6 N·m (3.4 lb.ft.).
- Extension rod nut to 33 N·m (24 lb.ft.).
- Guide plate bolts to 9 N·m (7 lb.ft.).

8. Gear shift control shaft to gear shift control lever and install control shaft bolt and nut.

Tighten

- Gear shift control shaft bolt and nut to 18 N·m (13 lb.ft.).

9. Lower vehicle.

Adjust

- Control lever vertical play to 0-0.2 mm (0. -0.007 in.).
- Control lever position "A" distance to 27 mm (10.6 in.) (Figure 17).

NOTICE:

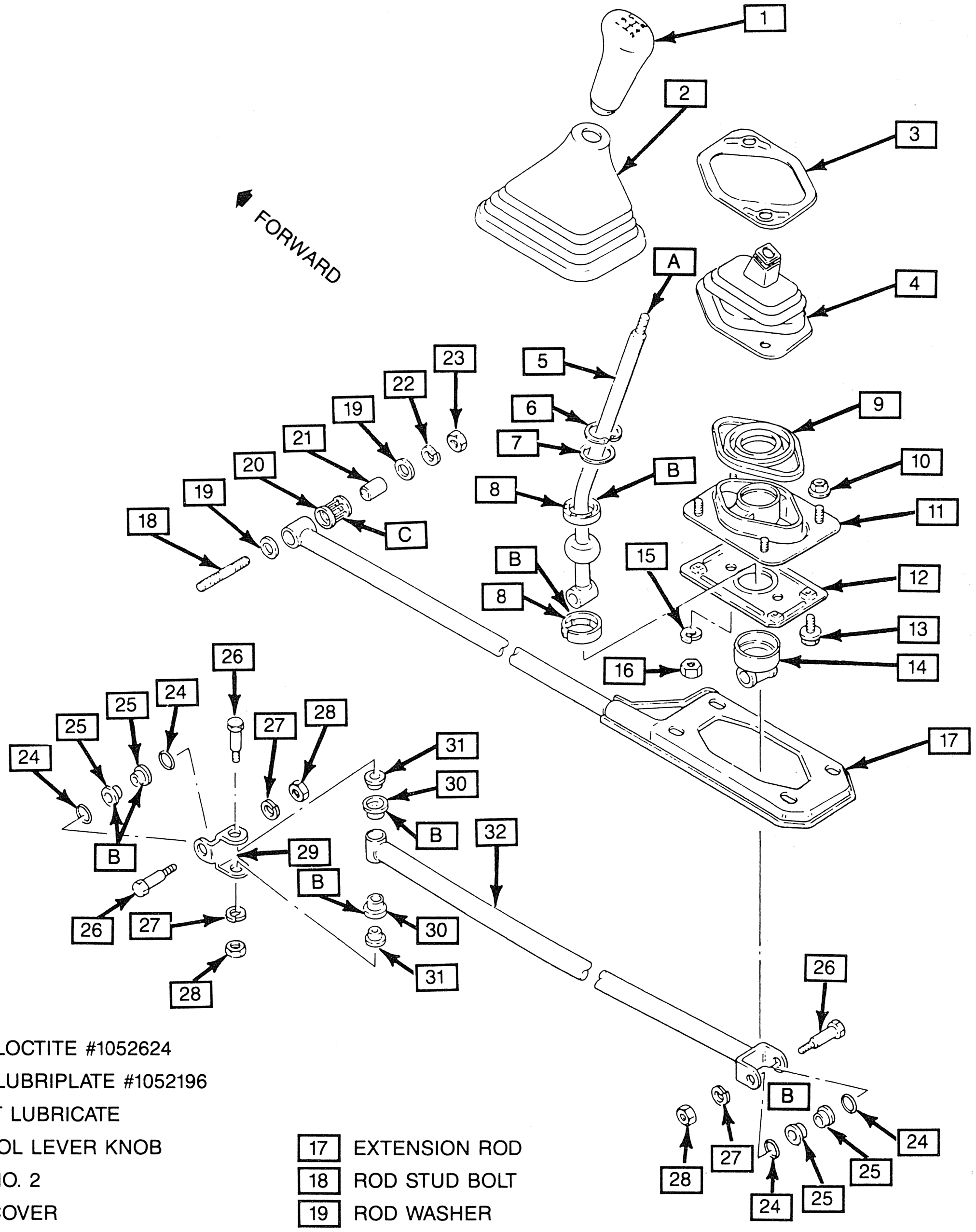
- Do not apply grease to extension rod bushing of transaxle end.
- Apply grease to gear shift control shaft bushings.
- Make sure that boots are installed correctly.

SPEEDOMETER DRIVEN GEAR

Figure 18

Remove or Disconnect

1. Pull up speedometer cable boot, pull out speedometer case clip and disconnect speedometer case clip, disconnect speedometer cable from case.
2. Bolt and pull out speedometer driven gear case assembly.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FORWARD
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18
19
20
21
22
23
C
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25
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24
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27
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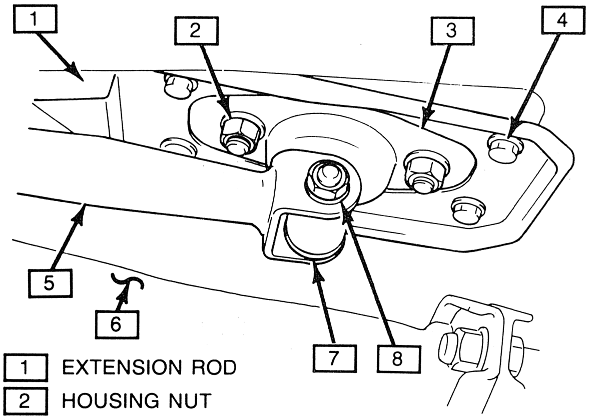
31
30
B
32
29
B
30
31
26
27
28
26
B
24
25
25
24
27
28

A APPLY LOCTITE #1052624
B APPLY LUBRIPLATE #1052196
C DO NOT LUBRICATE
1 CONTROL LEVER KNOB
2 BOOT NO. 2
3 BOOT COVER
4 BOOT
5 GEAR SHIFT CONTROL LEVER
6 SNAP RING
7 ADJUST SHIM
8 SEAT
9 HOUSING DUST COVER
10 HOUSING NUT
11 GEAR SHIFT CONTROL HOUSING
12 GUIDE PLATE
13 GUIDE PLATE BOLT
14 REAR BOOT
15 HOUSING LOCK WASHER
16 CONTROL HOUSING NUT
17 EXTENSION ROD
18 ROD STUD BOLT
19 ROD WASHER
20 ROD BUSHING
21 SPACER
22 ROD LOCK WASHER
23 ROD NUT
24 O-RING
25 CONTROL SHAFT BUSHING
26 CONTROL SHAFT BOLT
27 SHAFT LOCK WASHER
28 SHAFT NUT
29 GEAR SHIFT CONTROL JOINT
30 SHAFT OUTER BUSHING
31 SHAFT INNER BUSHING
32 GEAR SHIFT CONTROL SHAFT

KC1221-7B-M-RS

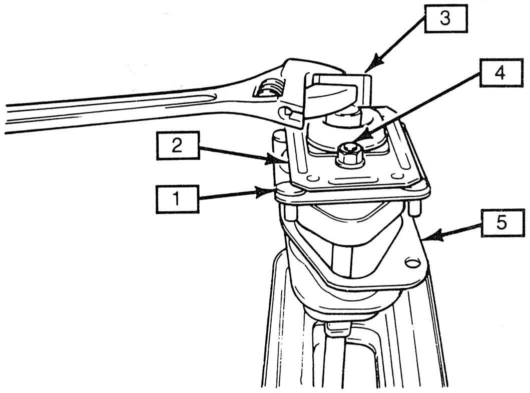
Figure 13 Gear Shift Control Components



1	EXTENSION ROD
2	HOUSING NUT
3	CONTROL LEVER GUIDE PLATE
4	GUIDE PLATE BOLT
5	GEAR SHIFT CONTROL SHAFT
6	EXHAUST NO. 1 PIPE
7	GEAR SHIFT CONTROL LEVER
8	CONTROL SHAFT BOLT & NUT

KC1222-7B-M-RS

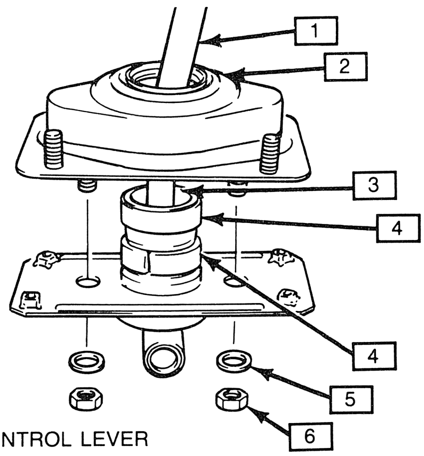
Figure 14 Gear Shift Control Lever Removal



1	GEAR SHIFT CONTROL HOUSING
2	CONTROL LEVER GUIDE PLATE
3	GEAR SHIFT CONTROL LEVER
4	HOUSING NUT
5	CONTROL LEVER BOOT

KC1223-7B-M-RS

Figure 15 Control Lever Knob Removal



1	SHIFT CONTROL LEVER
2	CONTROL HOUSING
3	SHIM
4	CONTROL LEVER SEAT
5	LOCK WASHER
6	HOUSING NUT

KC1224-7B-M-RS

Figure 16 Assembling Gear Shift Control Lever

3. Drive out spring pin with a punch 2.8 - 3.0 mm (0.11 in. diameter) and hammer, and remove speedometer driven gear.

4. Oil seal using J37764 and J23907. Hold driver gear case with special tool J34836.

Inspect

- Driven gear for abnormal wear or distortion.

Install or Connect

1. New oil seal into driven gear case with spring side facing down after using J37764, first apply grease #1052169. Special tool J37764 may be used for installation.
2. Driven gear into driver gear case applying grease #1052169.
3. Spring pin by supporting flat portion of driver gear case with a wood block.

Inspect

- Driven gear for smooth rotation.
- O-ring and case surface for flaws.

4. Case assembly to transaxle applying grease #1052196 to O-ring, then install bolt.

Tighten

- Case bolt to 6 N·m (4 lb.ft.).

5. Cable, case clip, and boot.

NOTICE:

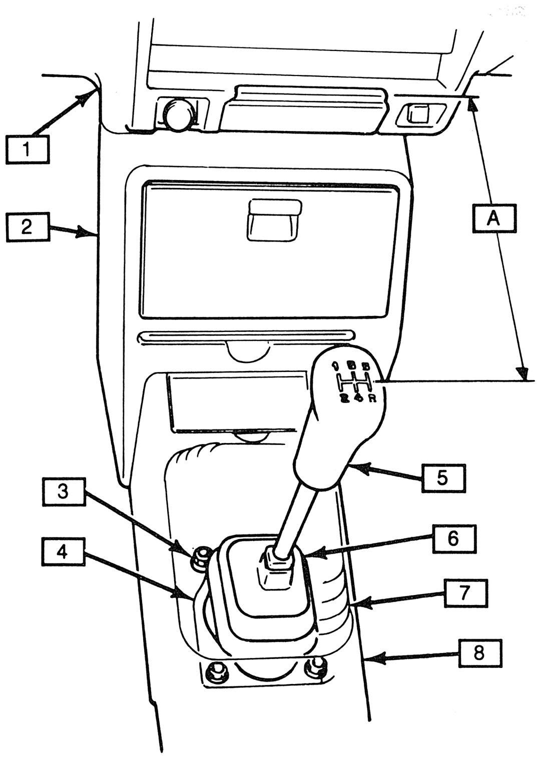
- To prevent distortion of oil seal, reframe from excessive compression.
- Never hit driven gear and gear case.
- While inserting case assembly into transaxle, rotate driver gear by using small screwdriver to ensure gears mesh smoothly.

TRANSAXLE ASSEMBLY

Figures 19 through 22

Remove or Disconnect

1. Battery ground cable.
2. Clutch cable adjusting nuts, retaining clip from cable, and cable from bracket.
3. Wiring harness clamps and connectors.
4. Speedometer cable boot, speedometer case clip, speedometer cable from case.

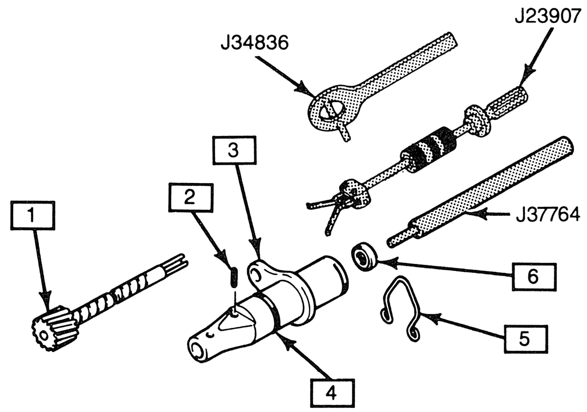


A CONTROL LEVER POSITION DISTANCE
1 INSTRUMENT PANEL
2 CONSOLE BOX
3 CONTROL LEVER HOUSING NUT
4 BOOT COVER
5 CONTROL LEVER KNOB
6 CONTROL LEVER BOOT
7 BOOT NO. 2
8 SHIFT CONTROL LEVER COVER

KC1225-7B-M-RS

Figure 17 Shift Control Lever Installation

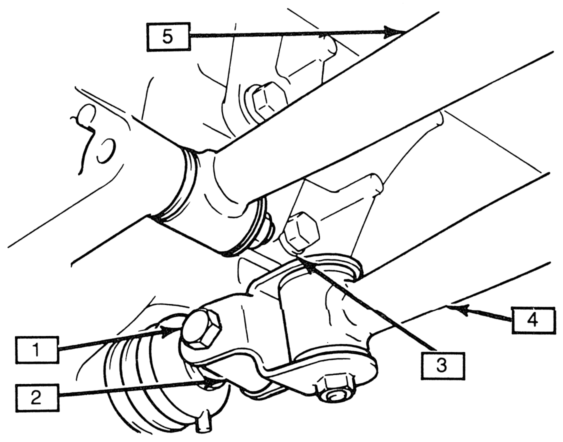
5. Transaxle retaining bolts.
6. Starter retaining bolts and starter. Also remove starter motor plate.
7. Vacuum hose from pressure sensor.
8. Install engine support to prevent engine from lowering excessively.
9. Hoist vehicle.
10. Drain transaxle oil.
11. Gear shift control shaft bolt and nut, and detach control shaft from gear shift shaft (Figure 19).
12. Extension rod nut and remove rod with washers (Figure 19).
13. Exhaust pipe front flange bolts.
14. Exhaust pipe rear flange nuts.
15. Clutch housing lower plate.
16. Left front wheel.
17. Left tie rod end using J21687-02.
18. Left ball joint by removing joint stud bolt.
19. Both drive axles at transaxle (Figure 20).
20. Transaxle to engine retaing bolts and nuts.
21. Support transaxle with a jack.



1 SPEEDOMETER DRIVEN GEAR
2 SPRING PIN
3 DRIVEN GEAR CASE
4 O-RING
5 CASE CLIP
6 OIL SEAL

KC1226-7B-M-RS

Figure 18 Speedometer Driven Gear



1 CONTROL SHAFT BOLT
2 GEAR SHIFT SHAFT
3 EXTENSION ROD NUT
4 GEAR SHIFT CONTROL SHAFT
5 EXTENSION ROD

KC1228-7B-M-RS

Figure 19 Rear Extension Rod

22. Two rear engine mounting nuts.

23. Three bolts and two nuts from transaxle mounting LH bracket, remove LH bracket (Figure 21).

24. Lower transaxle with engine attached in order to detach it from stud bolts at engine rear mounting portion, pull transaxle straight out toward left

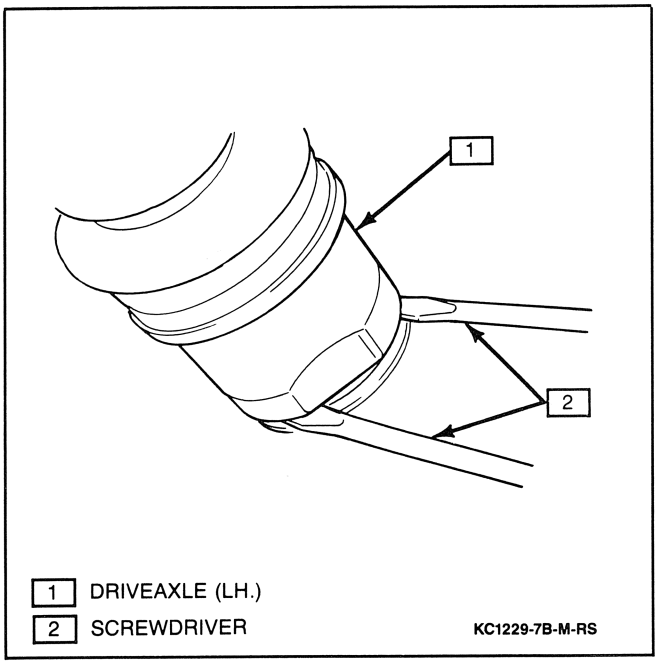


Figure 20 Drive Axle Removal

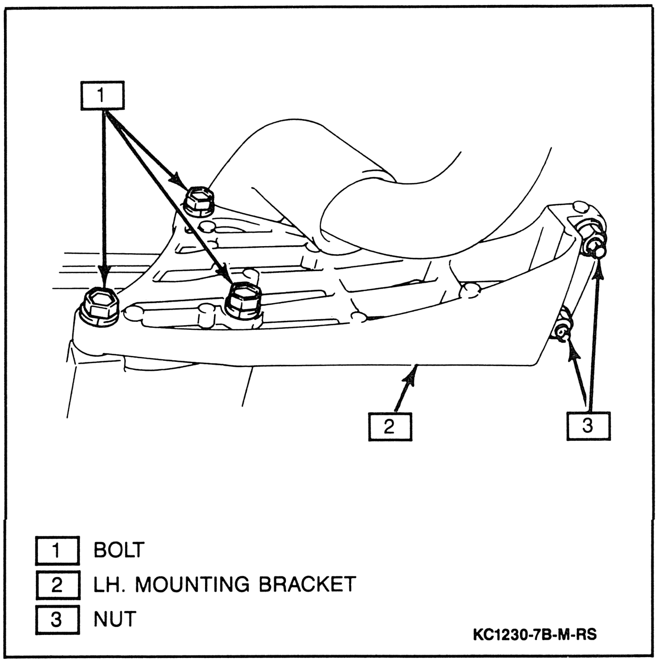


Figure 21 LH Mounting Bracket Removal

side to disconnect input shaft from clutch cover, lower and remove the transaxle assembly.

Install or Connect

1. Hoist vehicle.
2. Place transaxle on jack and raise into position attaching stud bolts at engine rear mounting portion an input shaft clutch assembly.

Important

- While transaxle is being raised, connect RH driveaxle into differential side.

3. Transaxle to engine bolts and nuts.

Tighten

- LH bracket three bolts and two nuts to 50 N·m (37 lb.ft.).

4. Transaxle mounting LH bracket with three bolts and two nuts.

Tighten

- Engine rear mounting nuts to 50 N·m (37 lb.ft.)

5. Two rear engine mounting nuts.
6. Lower transaxle supporting jack.

Tighten

- Transaxle to engine bolt and nut to 50 N·m (37 lb.ft.).

7. LH drive axle to transaxle.

Important

- Be sure to push each driveaxle in fully to engage snap rings with differential gear.

8. Left ball joint and ball joint stud bolt.

Tighten

- Ball joint bolt and nut to 60 N·m (44 lb.ft.).

9. Left tie rod end, castle nut and split pin.
10. Left front wheel.
11. Clutch housing lower plate.
12. Exhaust pipe rear flange nuts.
13. Exhaust pipe front flange nuts.
14. Extension rod nut and washers.

Tighten

- Extension rod nut to 33 N·m (24 lb.ft.).

15. Control shaft to gear shift and install gear shift control shaft bolt and nut.

Tighten

- Gear shift control shaft bolt and nut to 18 N·m (13 lb.ft.).

16. Fill transaxle.
17. Lower vehicle.
18. Remove engine support fixture.
19. Vacuum hose to pressure sensor.
20. Starter, starter motor plate, and two bolts.
21. Transaxle retaining bolts..

Tighten

- Fastening bolts to 50 N·m (37 lb.ft.).

22. Speedometer cable to case, speedometer case clip, and speedometer cable boot.
23. Wiring harness clamps and connectors.
24. Clutch cable to bracket, retaining clip to cable, and clutch cable adjusting nut.

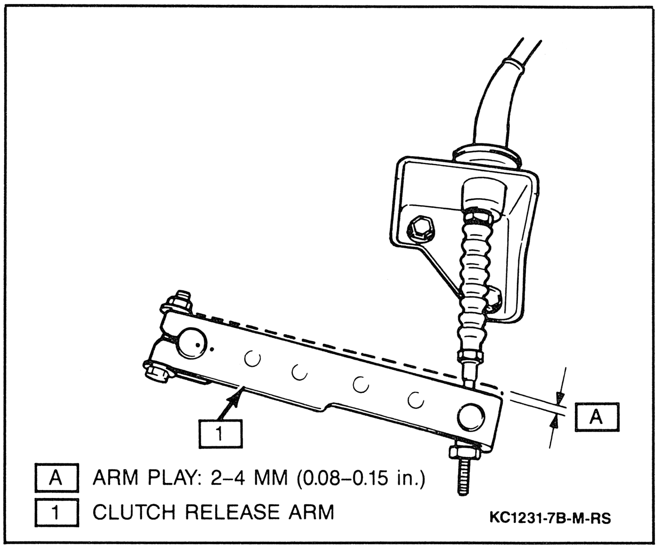

1
A
A ARM PLAY: 2–4 MM (0.08–0.15 in.)
1 CLUTCH RELEASE ARM
KC1231-7B-M-RS

Figure 22 Clutch Play Adjustment

Important

- After connecting clutch cable, be sure to adjust play properly. Refer to CLUTCH (Section 7C) (Figure 22).

25. Battery ground cable.

UNIT REPAIR

DISASSEMBLING TRANSAXLE

Figures 23 through 37

Remove or Disconnect

1. Transaxle side cover retaining bolts and cover.
2. Snap ring and hub plate (Figure 23).

NOTICE: Care shoud be take not to distort side cover when it is removed from left case.

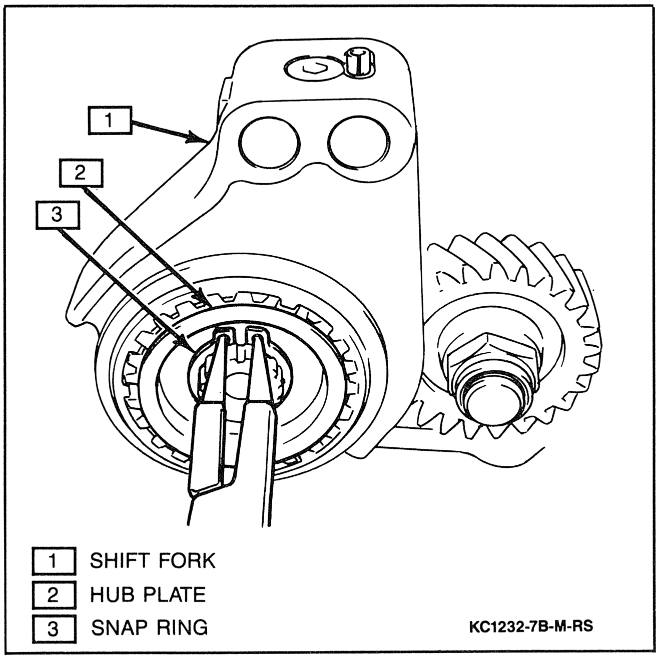

1
2
3
1 SHIFT FORK
2 HUB PLATE
3 SNAP RING
KC1232-7B-M-RS

Figure 23 Snap Ring and Hub Plate Removal

3. Shift fork plug and guide ball.
4. Drive out spring pin using punch and hammer.

Important

- Use of magnet would facilitate removal of guide ball (Figure 24).

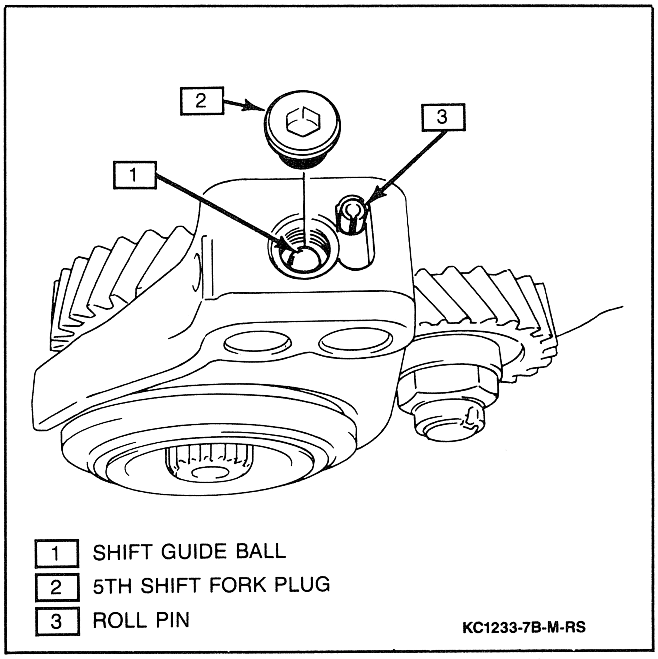

2
3
1
1 SHIFT GUIDE BALL
2 5TH SHIFT FORK PLUG
3 ROLL PIN
KC1233-7B-M-RS

Figure 24 Screw, Ball and Pin Removal

5. Gear shift fork, sleeve and hub assembly, synchronizer ring spring, synchronizer ring and 5th gear all together (Figure 25).

6. Staked portion of countershaft nut, install main shaft 5th gear and special tool J35309 to lock the

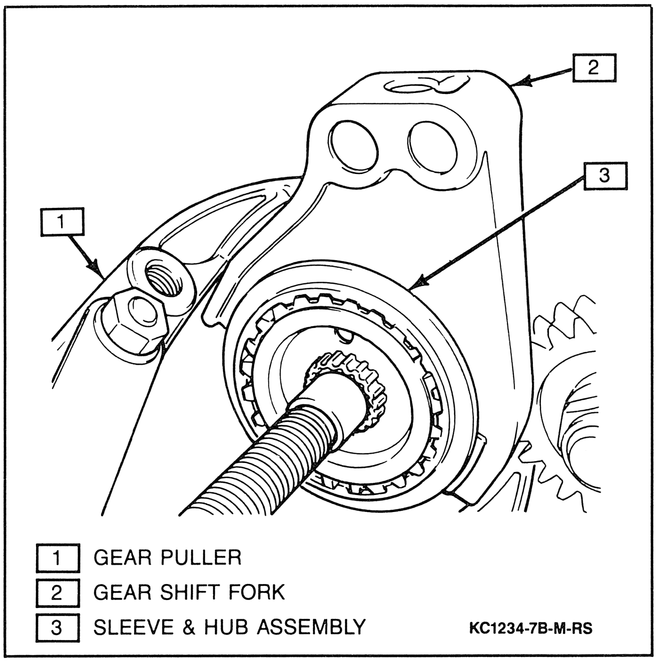

1
2
3
1 GEAR PULLER
2 GEAR SHIFT FORK
3 SLEEVE & HUB ASSEMBLY
KC1234-7B-M-RS

Figure 25 Sleeve and Hub Assembly Removal

rotation of the shafts, and then remove countershaft nut (Figure 26).

7. Special tool J35309, then remove main shaft 5th gear, needle bearing and counter shaft 5th gear using J22888-35 (Figure 27).
8. Six screws and take off left case plate, and remove bearing shim.

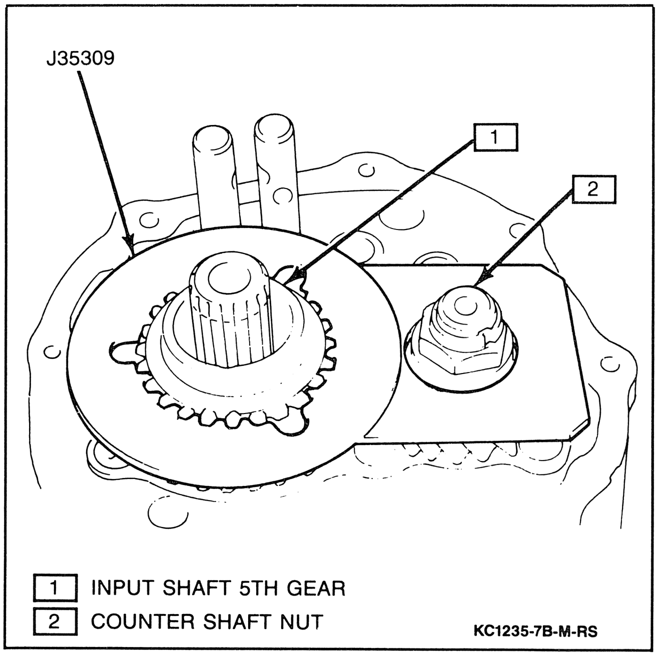

J35309
1
2
1 INPUT SHAFT 5TH GEAR
2 COUNTER SHAFT NUT
KC1235-7B-M-RS

Figure 26 Counter Shaft Nut Removal

9. Three bolts from left case cap and remove cap.
10. Gear shift yoke bolt (Figure 28).
11. Three gear shift fork shaft screws with washers, springs, and steel balls.

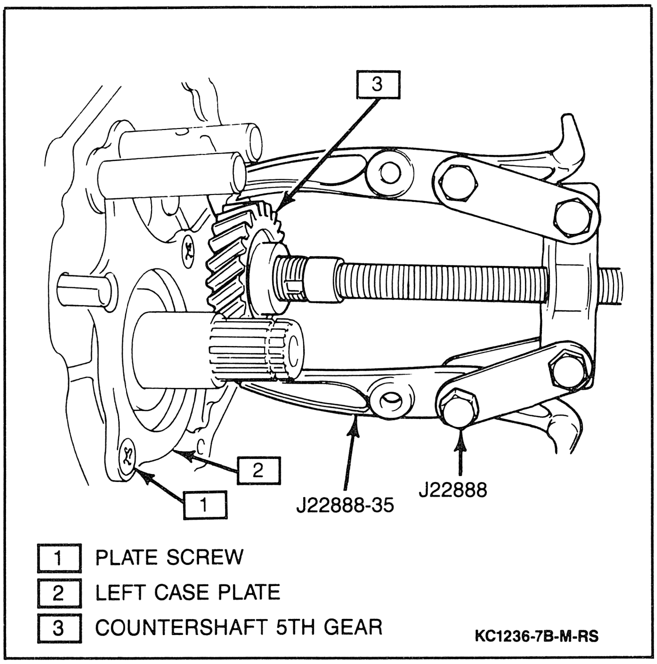

3
2
1
J22888-35
J22888
1 PLATE SCREW
2 LEFT CASE PLATE
3 COUNTERSHAFT 5TH GEAR
KC1236-7B-M-RS

Figure 27 5th Gear and Left Case Plate Removal

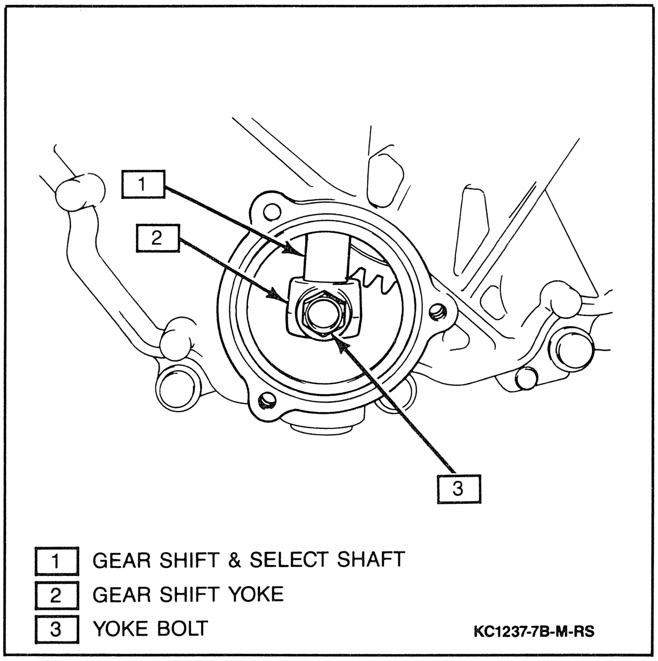

1
2
3
1 GEAR SHIFT & SELECT SHAFT
2 GEAR SHIFT YOKE
3 YOKE BOLT
KC1237-7B-M-RS

Figure 28 Gear Shift Yoke Bolt Removal

Important

- Springs are color coded. Make note of which hole each spring came from to aid in reassembly.

12. Four bolts from gear shift guide case, and remove wiring harness clamp and guide case (Figure 29).
13. Gear shift interlock bolt with washer (Figure 29).
14. Backup lamp switch (Figure 29).

Important

- Removal of 5th to Reverse interlock bolt is not necessary for removing gear shift and select shaft assembly.

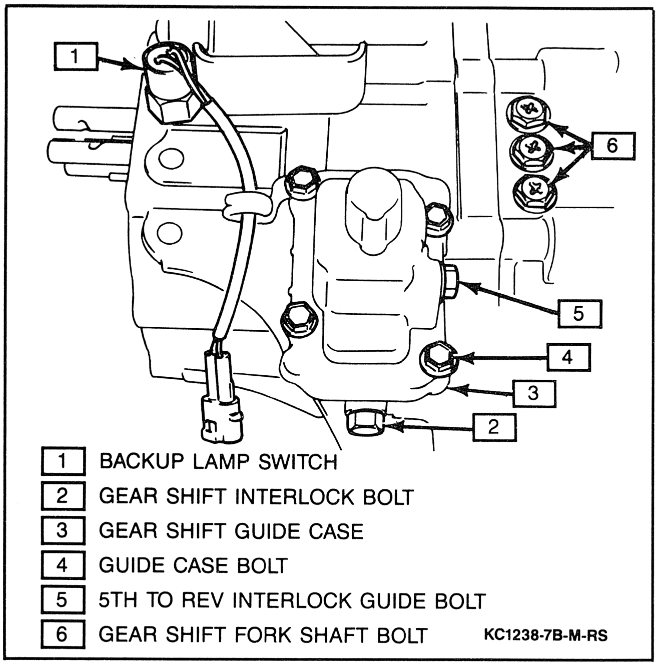

1
6
5
4
3
2
1 BACKUP LAMP SWITCH
2 GEAR SHIFT INTERLOCK BOLT
3 GEAR SHIFT GUIDE CASE
4 GUIDE CASE BOLT
5 5TH TO REV INTERLOCK GUIDE BOLT
6 GEAR SHIFT FORK SHAFT BOLT
KC1238-7B-M-RS

Figure 29 Gear Shift Guide Case Removal

15. Gear shift and select shaft assembly (Figure 30).
16. Reverse shaft bolt with washer.
17. Eleven case bolts from outside of transaxle and another two bolts from clutch housing side (Figure 31).

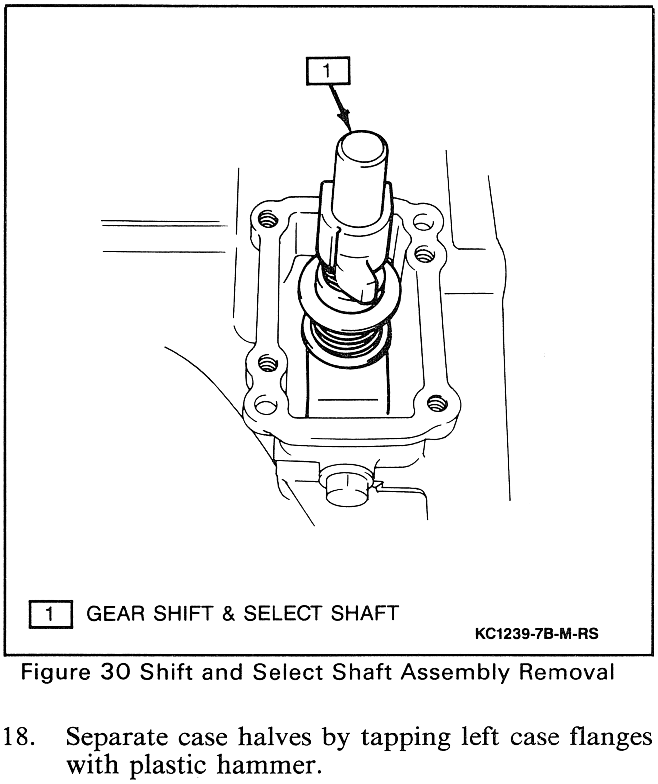

1
1 GEAR SHIFT & SELECT SHAFT
KC1239-7B-M-RS

Figure 30 Shift and Select Shaft Assembly Removal

18. Separate case halves by tapping left case flanges with plastic hammer.
19. Gear shift yoke.
20. Reverse gear shaft with washer, and remove reverse idler gear (Figure 32).
21. 5th and Reverse gear shift guide shaft together with 5th and Reverse gear shift shaft.

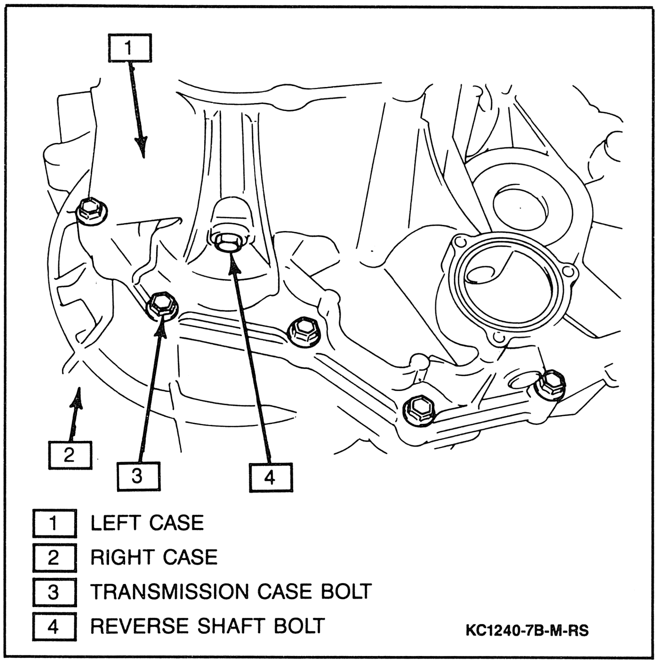

1
2
3
4
1 LEFT CASE
2 RIGHT CASE
3 TRANSMISSION CASE BOLT
4 REVERSE SHAFT BOLT
KC1240-7B-M-RS

Figure 31 Case Bolt Removal

Important

- When removing 5th and Reverse gear shift shaft and guide shaft, push up high speed gear shift shaft and shift it to 4th to remove 5th and Reverse shifter.

22. Input shaft assembly by tapping input end with plastic hammer. Then push assembly out from case. Remove input shaft assembly, counter shaft assembly, high speed gear shift shaft and low speed gear shift shaft together (Figure 33).

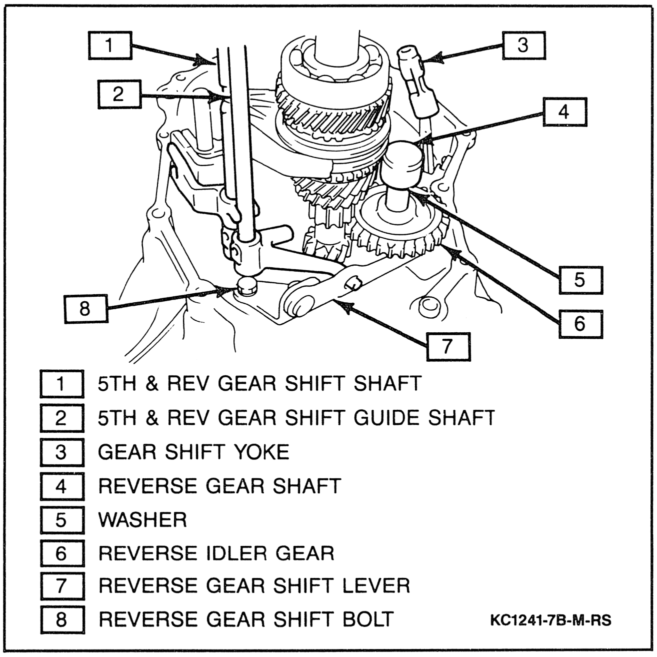
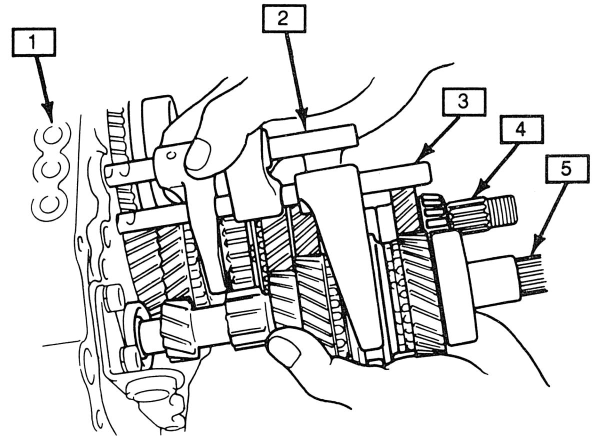

1
2
3
4
5
6
7
8
1 5TH & REV GEAR SHIFT SHAFT
2 5TH & REV GEAR SHIFT GUIDE SHAFT
3 GEAR SHIFT YOKE
4 REVERSE GEAR SHAFT
5 WASHER
6 REVERSE IDLER GEAR
7 REVERSE GEAR SHIFT LEVER
8 REVERSE GEAR SHIFT BOLT
KC1241-7B-M-RS

Figure 32 Reverse Idler Gear Removal

23. Countershaft LH bearing race from left case using J29369-2 with J23907.
24. Differential side LH oil seal.

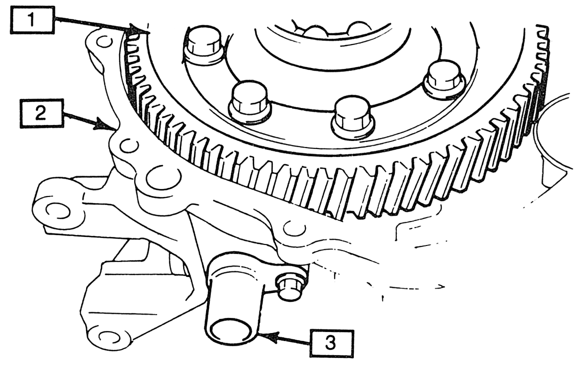


1 RIGHT CASE
2 LOW SPEED GEAR SHIFT SHAFT
3 HIGH SPEED GEAR SHIFT SHAFT
4 COUNTERSHAFT ASSEMBLY
5 INPUT SHAFT ASSEMBLY

KC1242-7B-M-RS

Figure 33 Input and Countershaft Removal

25. Differential gear assembly from right case.
26. Speedometer driven gear case with gear (Figure 34).



1 DIFFERENTIAL ASSEMBLY
2 TRANSMISSION RIGHT CASE
3 SPEEDOMETER DRIVEN GEAR CASE ASSEMBLY

KC1243-7B-M-RS

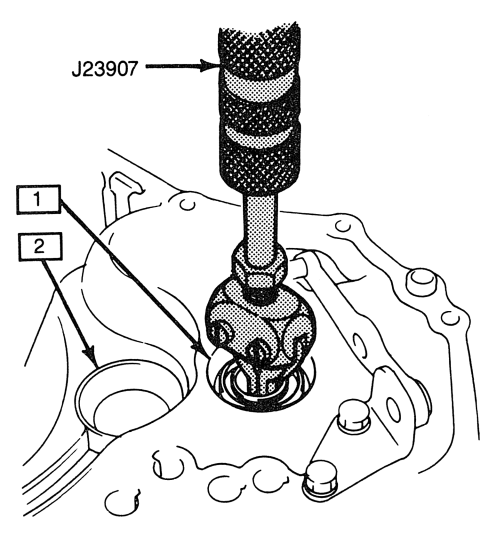
Figure 34 Differential Assembly Removal

27. Remove input shaft oil seal using tools J23907 with legs (Figure 35).
28. Countershaft RH bearing race using J29369-2 with J23907.

Important

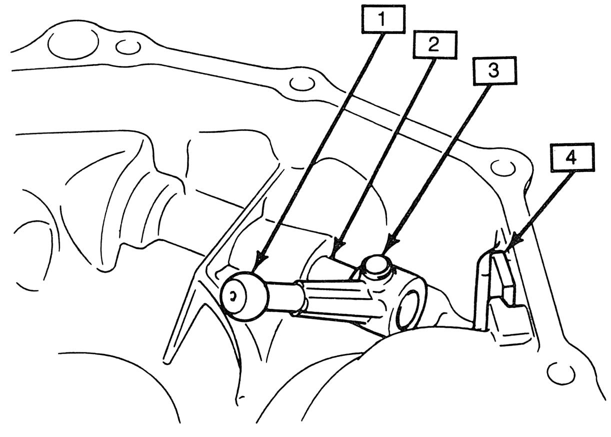
- If input shaft RH bearing has been left in right case, remove it using J23907 with puller legs.

29. Magnet from case.
30. Drive out roll pin and remove gear shift arm (Figure 36).
31. Gear shift shaft bolt with washer, spring, and steel ball.



1 INPUT SHAFT OIL SEAL
2 COUNTERSHAFT RH. BEARING RACE KC1244-7B-M-RS

Figure 35 Input Shaft Oil Seal Removal



1 GEAR SHIFT ARM
2 GEAR SHIFT SHAFT
3 PIN
4 MAGNET

KC1245-7B-M-RS

Figure 36 Gear Shift Arm Removal

32. Gear shift shaft, boot and oil seal (Figure 37).
33. Differential side RH oil seal from right case.

RIGHT CASE

Figures 38 through 41

Assemble

1. Reverse gear shift lever if removed, apply loctite #105264 to the retaining bolts (Figure 38).
2. Input shaft oil seal with its spring side upward using J34855. Apply grease #1052146 to oil seal lip (Figure 38).
3. Countershaft RH bearing race using J34849 with J7079-2 (Figure 38).

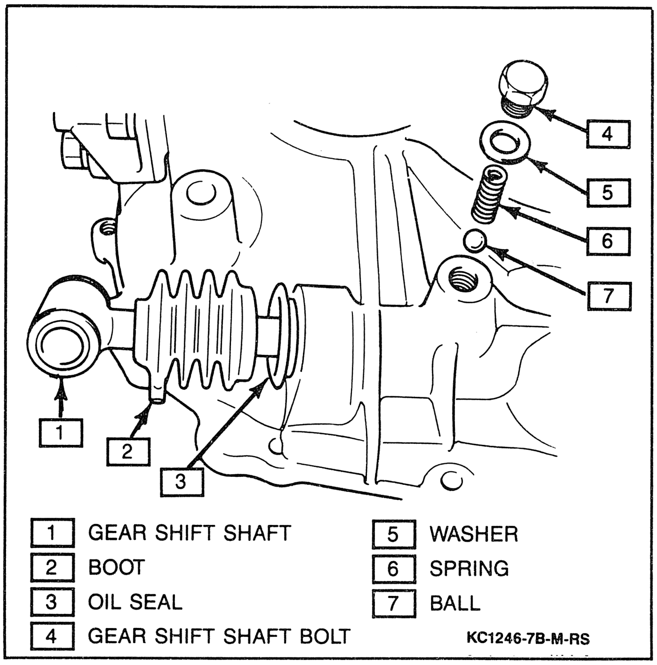

4
5
6
7
1
2
3
1 GEAR SHIFT SHAFT
2 BOOT
3 OIL SEAL
4 GEAR SHIFT SHAFT BOLT
5 WASHER
6 SPRING
7 BALL
KC1246-7B-M-RS

Figure 37 Gear Shift Shaft Removal

Important

- When installing reverse gear shift lever, set distance A between lever end and shaft bore to be 5 mm (0.2 in.).
- Distance A can be measured by installing the reverse gear shaft.
- When A is 5 mm (0.02 in.), clearance between reverse idler gear groove and shift lever end will be 1 mm (0.04 in.).

Tighten

- Reverse gear shift lever bolts to 23 N·m (17 lb.ft.).

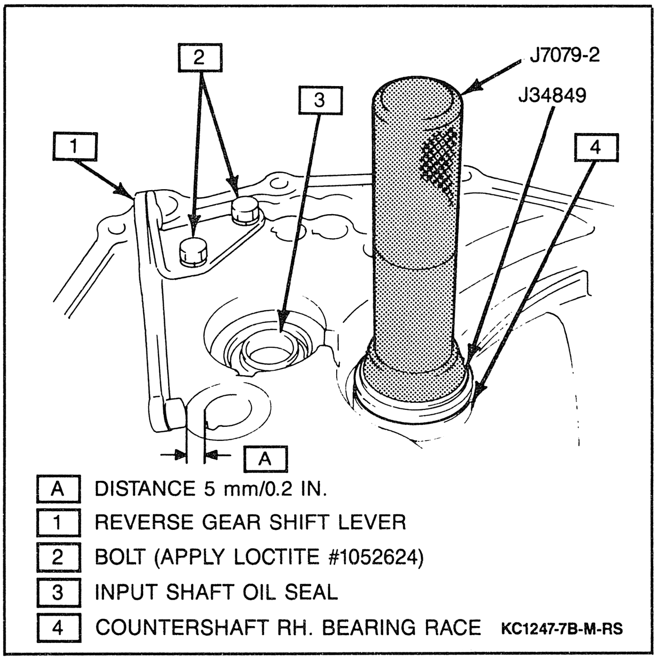

2
J7079-2
3
J34849
1
4
A
A DISTANCE 5 mm/0.2 IN.
1 REVERSE GEAR SHIFT LEVER
2 BOLT (APPLY LOCTITE #1052624)
3 INPUT SHAFT OIL SEAL
4 COUNTERSHAFT RH. BEARING RACE
KC1247-7B-M-RS

Figure 38 Reverse Gear Shift Lever Installation

4. Apply grease #1052196 to gear shift shaft oil seal lip and install oil seal using J34857 (Figure 39).

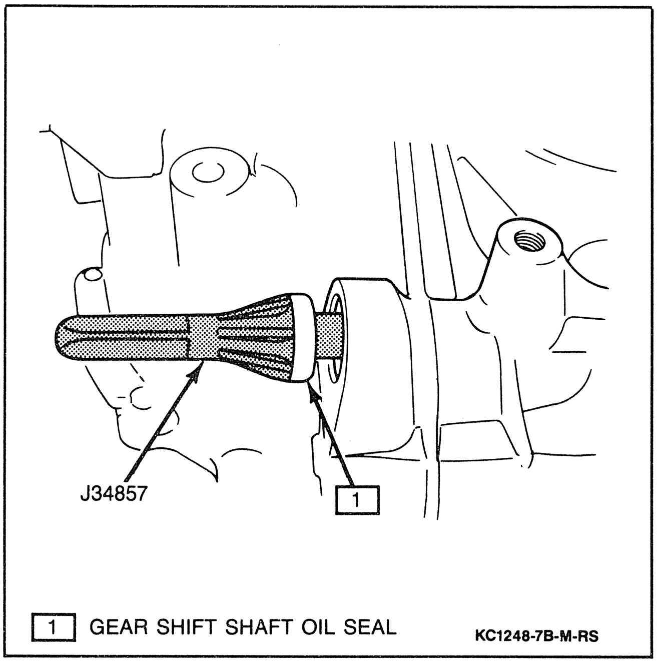

J34857
1
1 GEAR SHIFT SHAFT OIL SEAL
KC1248-7B-M-RS

Figure 39 Gear Shift Shaft Oil Seal Installation

5. Gear shift shaft, boot, steel ball, spring and apply sealant #1052751 (Figure 40).
6. Differential side RH oil seal and tighten bolt with washer flush with case surface using J37752 and apply grease #1052196 to its seal lip (Figure 40).
7. Gear shift shaft oil seal with spring side towards case.
8. Dust boot over shift shaft.

   Tighten

   - Gear shift shaft detent bolt to 13 N·m (10 lb.ft.).
9. Gear shift arm onto gear shift shaft, and install roll pin coated with loctite # 1052624 (Figure 41).
10. Magnet into case as it was (Figure 41).

LEFT CASE

Figures 42 and 43

Assemble

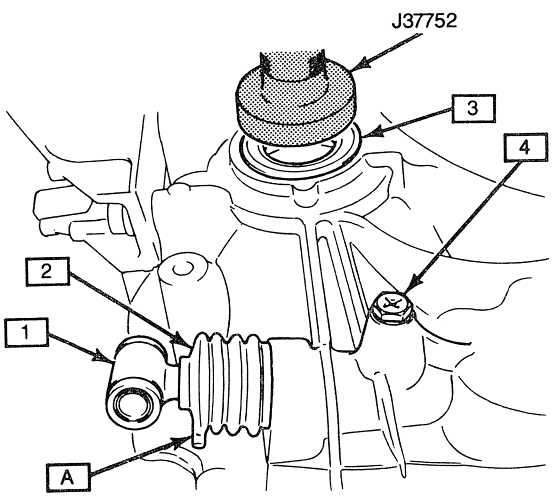
1. If input oil gutter has been removed, install it with bolt coated with loctite #1052624 (Figure 42)

   Tighten

   - Oil gutter to 6 N·m (4 lb.ft.).
2. Differential side LH oil seal flush with case using J29130 with J8092. Apply grease #1052196 to seal lip (Figure 43).

   Important

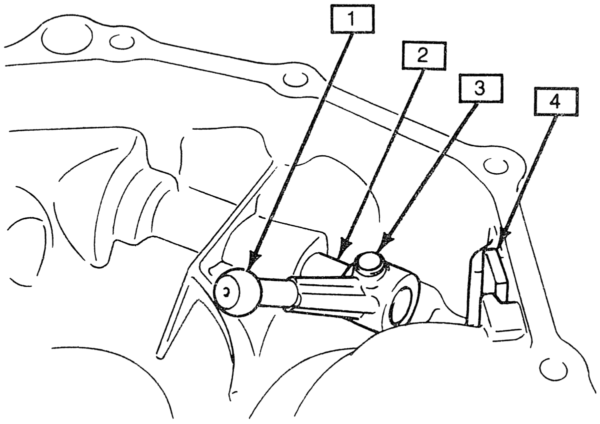
   - Install oil seal spring side towards case.



A BREATHER (BRING IT DOWNWARD)
1 GEAR SHIFT SHAFT
2 BOOT
3 DIFFERENTIAL SIDE RH. OIL SEAL
4 BOLT (APPLY SILICONE SEALER #1052751)

KC1249-7B-M-RS

Figure 40 Gear Shift Shaft Installation

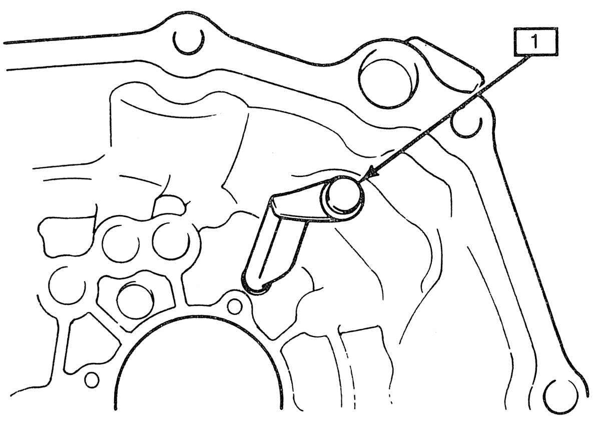


1 GEAR SHIFT ARM
2 GEAR SHIFT SHAFT
3 PIN
4 MAGNET

KC1250-7B-M-RS

Figure 41 Gear Shift Arm Installation

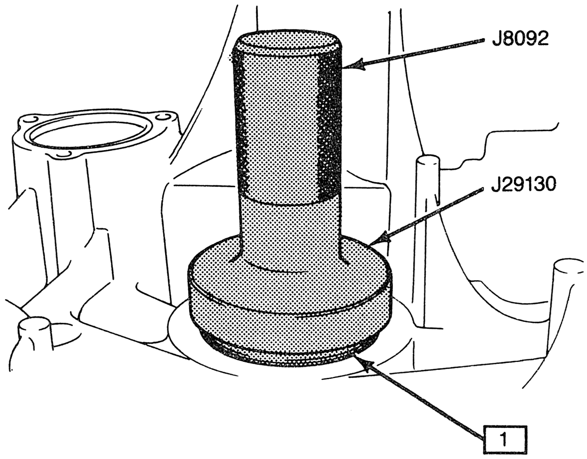
3. Countershaft LH bearing race into case by tapping with plastic hammer lightly.



1 OIL GUTTER BOLT (APPLY LOCTITE #1052624)

KC1251-7B-M-RS

Figure 42 Oil Gutter Installation



1 DIFFERENTIAL SIDE LH. OIL SEAL KC1252-7B-M-RS

Figure 43 Differential Side LH Oil Seal Installation

INPUT SHAFT ASSEMBLY

Figures 44 through 54

Disassemble

1. Input shaft RH bearing using J22912-01 (inverted) and press (Figure 44).
2. Drive out 5th gear spacer, LH bearing and 4th gear together using J29912-01 (inverted) and press (Figure 45).

NOTICE:

- To avoid gear teeth from being damaged, support gear on flat side of bearing puller.
- Stop press in the middle and take out 5th gear bush to prevent it from being compressed, continue to remove bearing with gear.

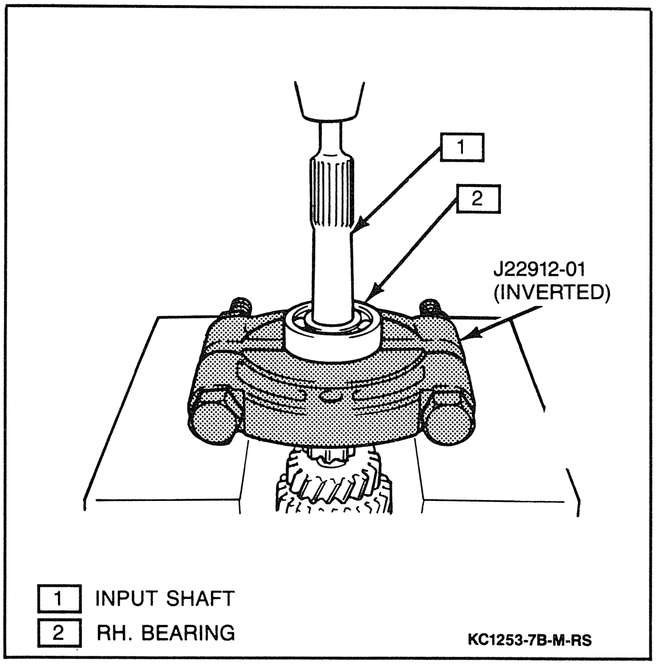

1
2
J22912-01
(INVERTED)
1 INPUT SHAFT
2 RH. BEARING
KC1253-7B-M-RS

Figure 44 Input Shaft RH Bearing Removal

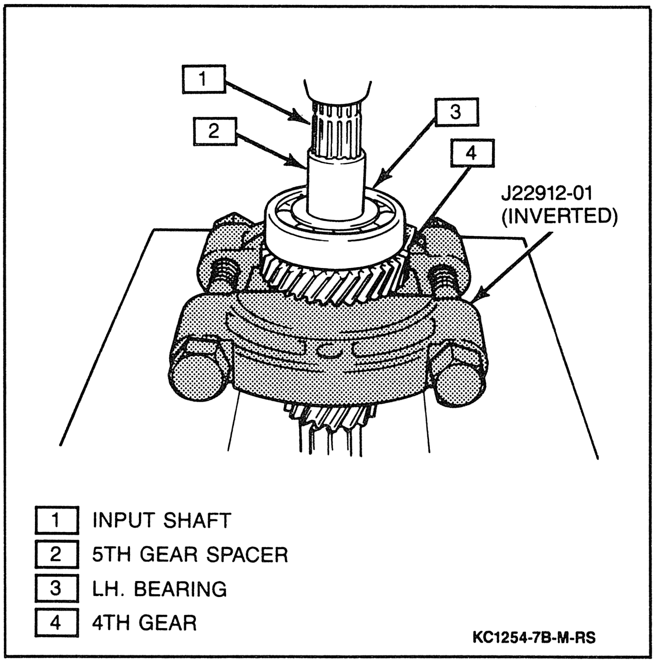

1
2
3
4
J22912-01
(INVERTED)
1 INPUT SHAFT
2 5TH GEAR SPACER
3 LH. BEARING
4 4TH GEAR
KC1254-7B-M-RS

Figure 45 Input Shaft LH Bearing Removal

3. 4th gear needle bearing and high speed synchronizer ring.
4. Snap ring using snap ring pliers (Figure 46).
5. Drive out high speed synchronizer sleeve and hub assembly together with 3rd gear using J22912-01 (inverted) and press (Figure 47).

NOTICE: Make sure to use flat side of puller to avoid damage to 3rd gear teeth.

6. 3rd gear needle bearing from shaft.
7. Synchronizer sleeve and hub assembly.

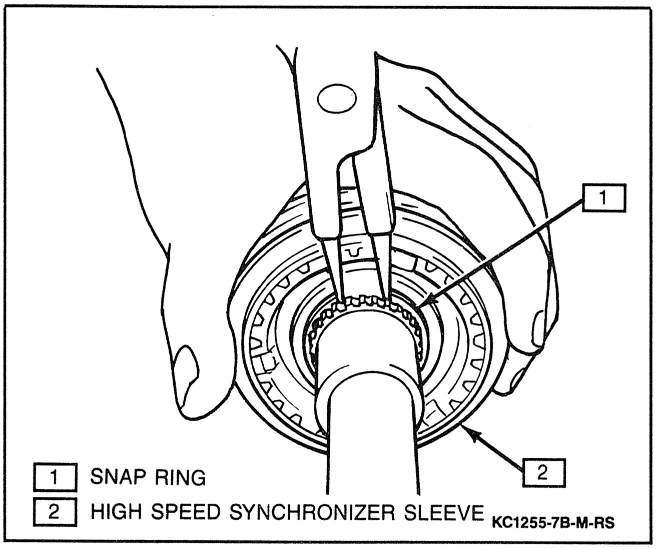

1
2
1 SNAP RING
2 HIGH SPEED SYNCHRONIZER SLEEVE
KC1255-7B-M-RS

Figure 46 Snap Ring Removal

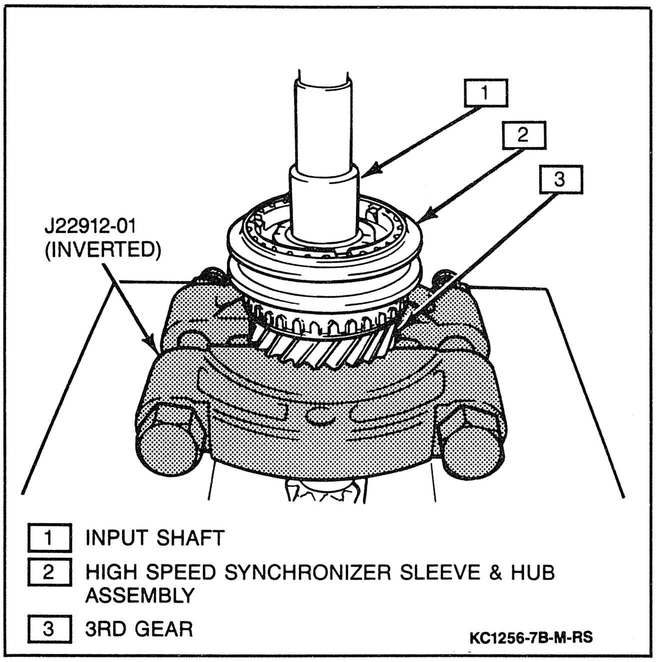

1
2
3
J22912-01
(INVERTED)
1 INPUT SHAFT
2 HIGH SPEED SYNCHRONIZER SLEEVE & HUB ASSEMBLY
3 3RD GEAR
KC1256-7B-M-RS

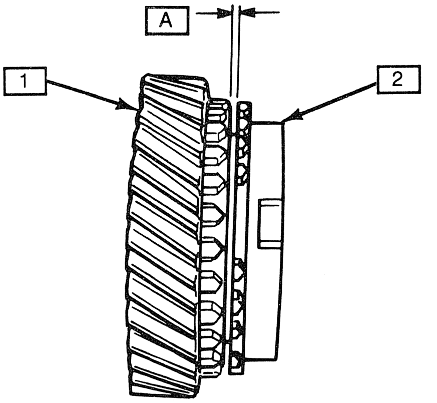
Figure 47 High Speed Sleeve And Hub Removal

Clean

- All components thoroughly.

Inspect

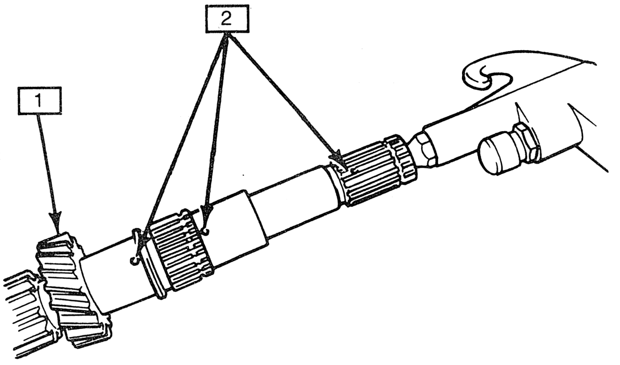
- All components for any abnormality and replace if necessary.
- Sychronizer assembly, check clearance "A" between ring and gear, each chamfered tooth of gear, ring, and sleeve. Replace if necessary (Figure 48).
- Standard clearance "A" is 1.0 - 1.4 mm (0. 039 - 0.055 in.).
- Service limit "A" is 0.5 mm (0.019 in.).



A MINIMUM 0.5 MM/0.019 IN.
1 GEAR
2 SYNCHRONIZER RING

KC1257-7B-M-RS

Figure 48 Gear and Synchronizer Ring Inspection



1 INPUT SHAFT
2 OIL HOLE

KC1258-7B-M-RS

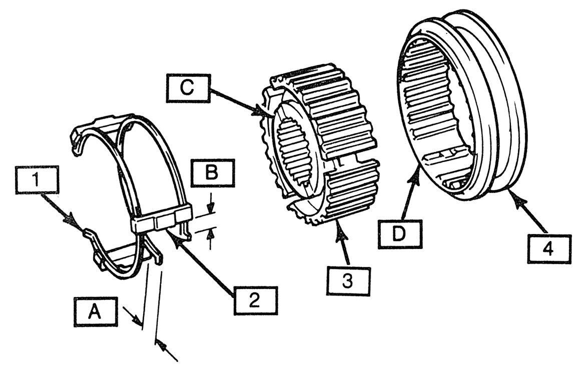
Figure 49 Oil Hole Inspection

Important

- To ensure lubrication, air blow oil holes and make sure that they are free from any obstruction (Figure 49).

Assemble

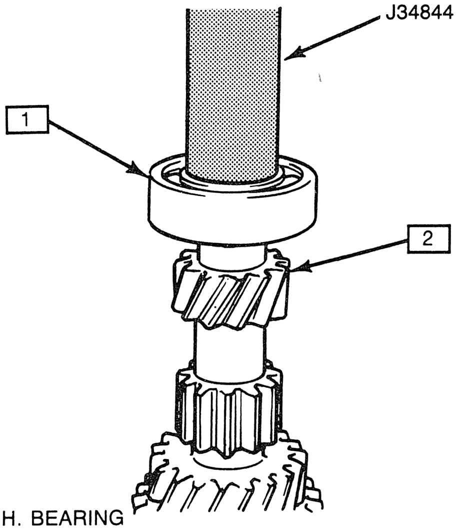
1. High speed synchronizer sleeve to hub (Figure 50).
2. Right bearing using J34844 (Figure 51).
3. 3rd gear needle bearing, apply oil to it, then install 3rd gear and synchronizer ring.
4. Drive in high speed sleeve and hub assembly using J35283 and hammer (Figure 52).



A = B
C LEFT SIDE (SHORT FLANGE)
D KEY WAY
1 HIGH SPEED SYNCHRONIZER SPRING
2 KEY
3 HUB
4 SLEEVE

KC1259-7B-M-RS

Figure 50 High Speed Sleeve Hub Assembly



1 RH. BEARING
2 INPUT SHAFT

KC1260-7B-M-RS

Figure 51 Input Shaft RH. Bearing Press-Fit

- While press-fitting sleeve and hub, make sure that synchronizer ring key slots are aligned with keys in sleeve and hub assembly.
- Check free rotation of 3rd gear after press-fitting sleeve and hub assembly.
- Needle bearings and synchronizer rings for 3rd and 4th are identical respectively.

5. Snap ring, needle bearing, apply oil to bearing, then install synchronizer ring and 4th gear (Figure 53).

CAUTION: Confirm that snapring is installed in groove securely.

6. Left bearing using J34844 and hammer (Figure 54).

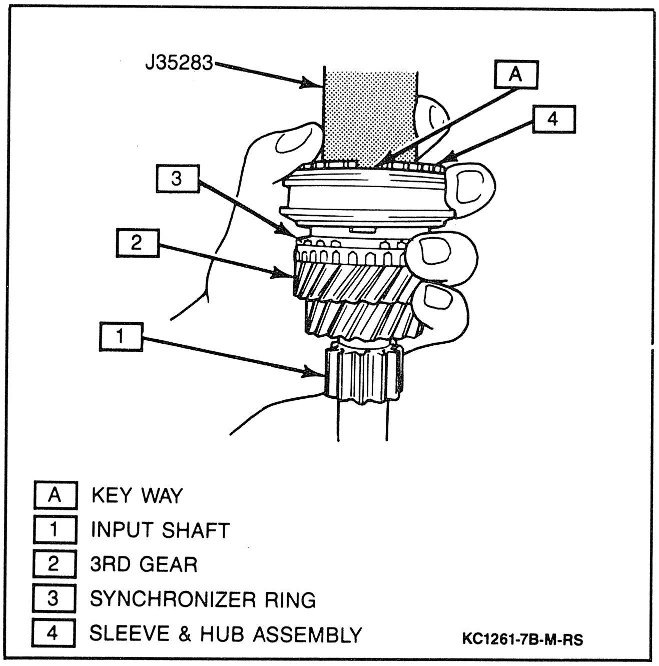

J35283
A
4
3
2
1
A KEY WAY
1 INPUT SHAFT
2 3RD GEAR
3 SYNCHRONIZER RING
4 SLEEVE & HUB ASSEMBLY
KC1261-7B-M-RS

Figure 52 High Speed Sleeve Assembly

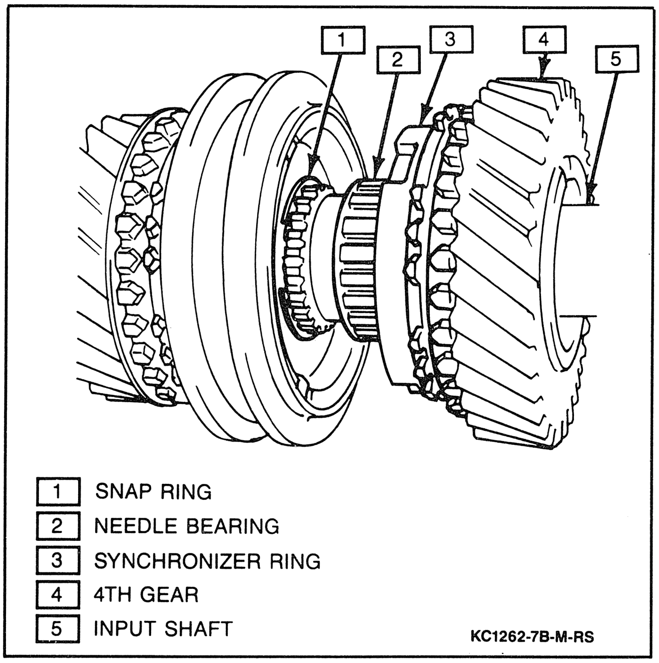

1
2
3
4
5
1 SNAP RING
2 NEEDLE BEARING
3 SYNCHRONIZER RING
4 4TH GEAR
5 INPUT SHAFT
KC1262-7B-M-RS

Figure 53. Snap Ring Installation

7. 5th gear spacer using J34844 and hammer (Figure 54).

CAUTION: To prevent 5th gear spacer from being distorted because of excessive compression, do not press-fit it with LH. bearing at once.

Countershaft Assembly

↔ Remove or Disconnect

1. Drive out LH. bearing with 4th gear using J22912-01 (inverted) and press (Figure 55.)

CAUTION:

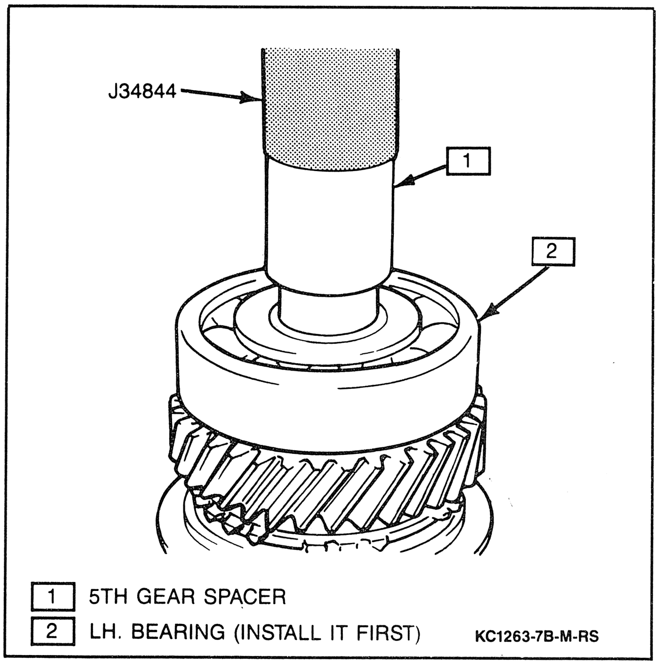

J34844
1
2
1 5TH GEAR SPACER
2 LH. BEARING (INSTALL IT FIRST)
KC1263-7B-M-RS

Figure 54. LH. Bearing and Spacer Press-Fit

- Use puller and press that will bear at least 5 tons (11,000 lb.) safely.
- To avoid tooth damage, support 4th gear at flat side of puller.

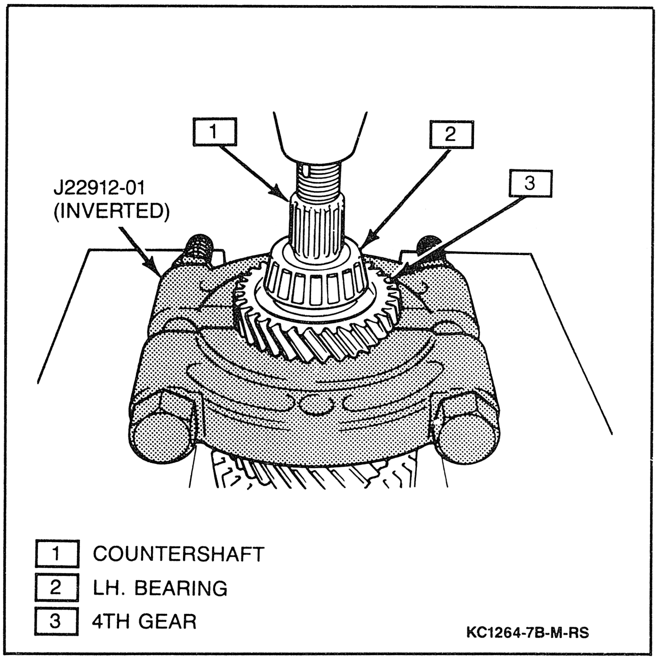

1
2
3
J22912-01
(INVERTED)
1 COUNTERSHAFT
2 LH. BEARING
3 4TH GEAR
KC1264-7B-M-RS

Figure 55 Countershaft 4th Gear Removal

2. Drive out 3rd and 4th gear spacer together with 2nd gear using J22912-01 (inverted) and press. Needle bearing comes out with 2nd gear (Figure 56).

CAUTION: If compression exceeds 5 tons (11,000 lb.), release compression once, reset puller support and then continue press work again.

3. 2nd sychronizer ring.
4. Snap ring using snap ring pilers (Figure 57).

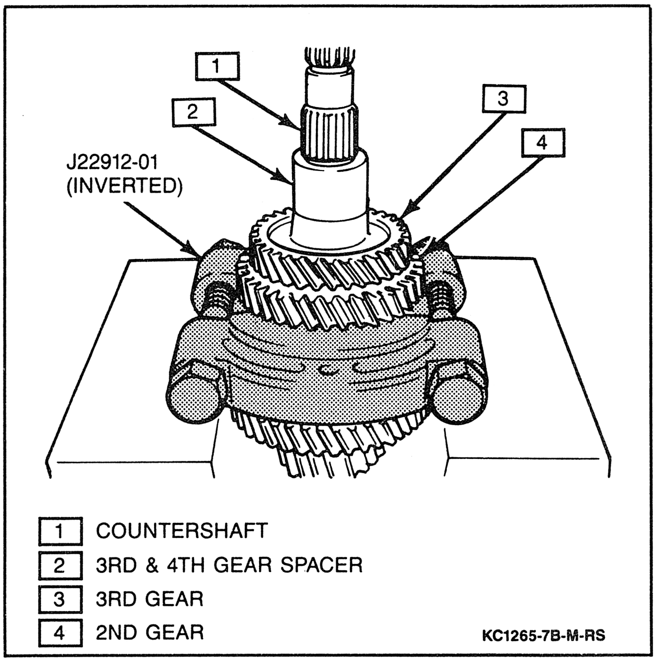

1
2
3
4
J22912-01
(INVERTED)
1 COUNTERSHAFT
2 3RD & 4TH GEAR SPACER
3 3RD GEAR
4 2ND GEAR
KC1265-7B-M-RS

Figure 56 Spacer and 3rd Gear Removal

NOTICE: Correct tool tips to be flat to facilitate removal of snap ring.

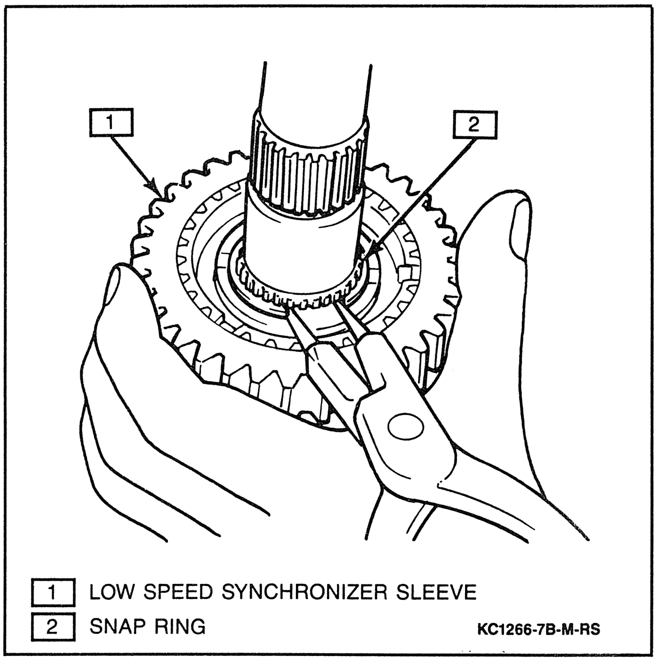

1
2
1 LOW SPEED SYNCHRONIZER SLEEVE
2 SNAP RING
KC1266-7B-M-RS

Figure 57 Snap Ring Removal

5. Drive out low speed synchronizer sleeve and hub assembly together with 1st gear using J22912-01 (inverted) and press (Figure 58).
6. Disassemble synchronizer sleeve and hub assembly.
7. Needle bearing from shaft.
8. Right bearing using J22912-01 (inverted), metal rod and press (Figure 59).

Clean

- All components thoroughly.

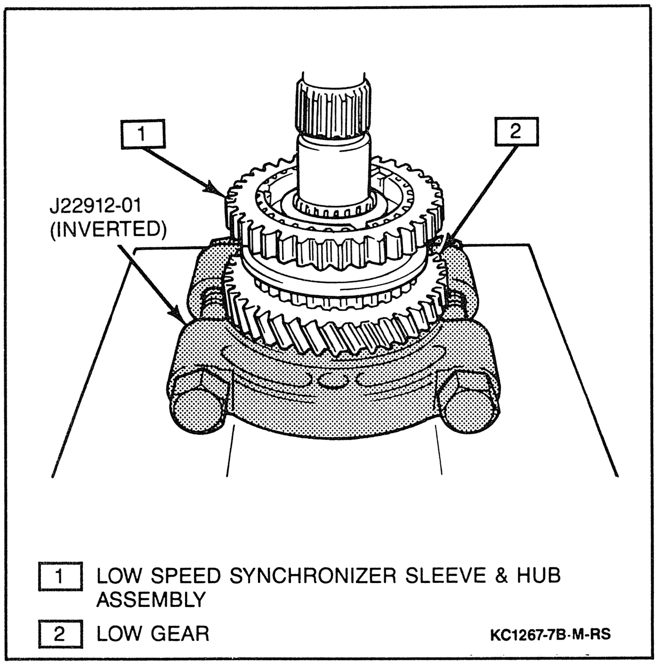

1
2
J22912-01
(INVERTED)
1 LOW SPEED SYNCHRONIZER SLEEVE & HUB ASSEMBLY
2 LOW GEAR
KC1267-7B-M-RS

Figure 58 Low Speed Sleeve and Hub Removal

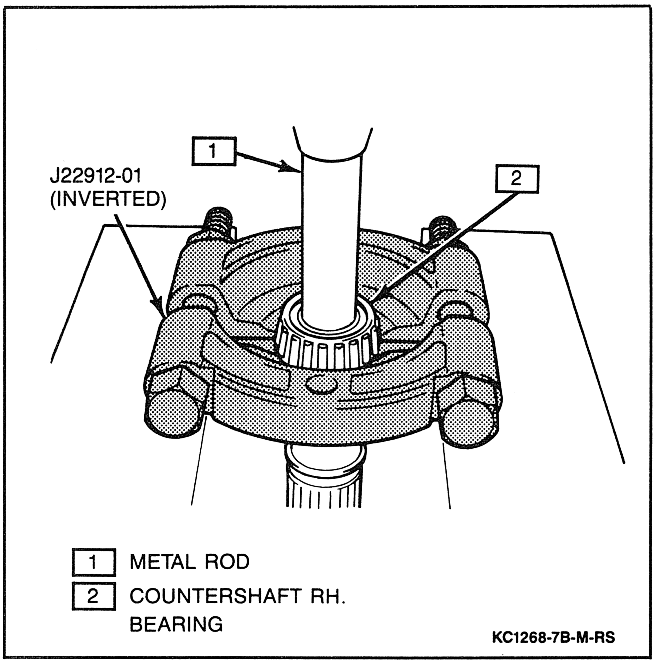

1
2
J22912-01
(INVERTED)
1 METAL ROD
2 COUNTERSHAFT RH. BEARING
KC1268-7B-M-RS

Figure 59 Countershaft RH. Bearing Removal

Inspect

- All components for abnormalities and replace with new ones as necessary.
- Synchronizer parts, if repair is necessary check clearance A between ring and gear, each chamfered tooth of gear, ring and sleeve, then determine parts replacement (Figure 60).
- Standard clearance A is 1.0 - 1.4 mm (0.039 - 0.055 in.).
- Service limit A is 0.5 mm (0.019 in.).

3. To ensure lubrication, air blow oil holes and make sure that they are free from any obstruction (Figure 61).

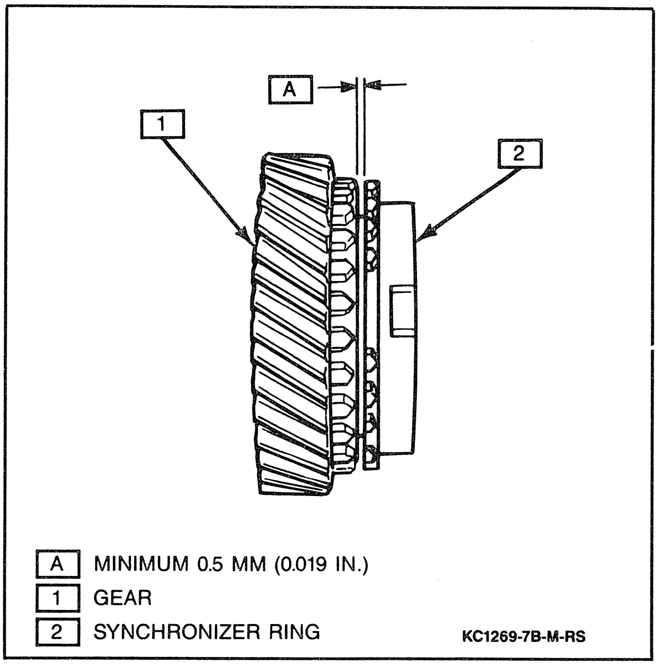

A
1
2
A MINIMUM 0.5 MM (0.019 IN.)
1 GEAR
2 SYNCHRONIZER RING
KC1269-7B-M-RS

Figure 60 Gear and Synchronizer Ring Inspection

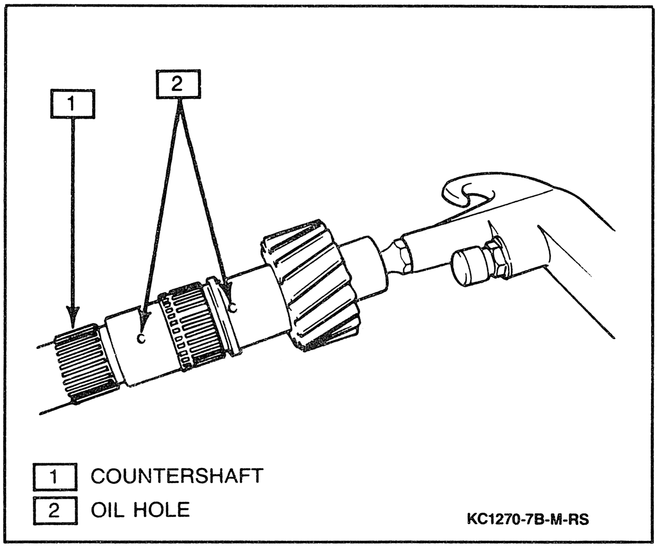

1
2
1 COUNTERSHAFT
2 OIL HOLE
KC1270-7B-M-RS

Figure 61 Oil Hole Inspection

Install or Connect

1. Low speed synchronizer sleeve to hub, insert three keys, then set springs (Figure 62).

NOTICE:

- No specific direction is assigned to low speed synchronizer hub or each key, but it is assigned as an assembly.
- Size of low speed synchronizer keys and springs are largest compared with those of high speed and 5th speed ones.

2. Right bearing using J34846 and hammer (Figure 63.)
3. Needle bearing, apply oil, then install 1st gear and 1st gear synchronizer ring (Figure 64).

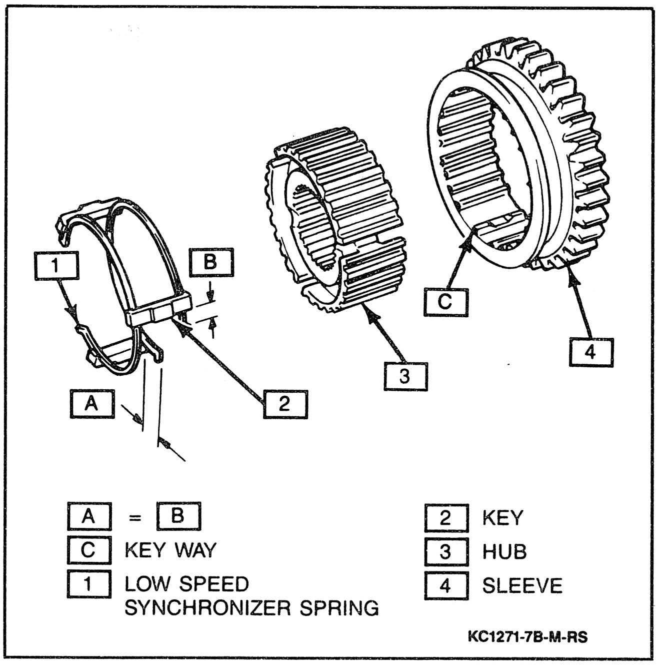

1
B
C
4
3
A
2
A = B
C KEY WAY
1 LOW SPEED SYNCHRONIZER SPRING
2 KEY
3 HUB
4 SLEEVE
KC1271-7B-M-RS

Figure 62 Low Speed Sleeve and Hub Assembly

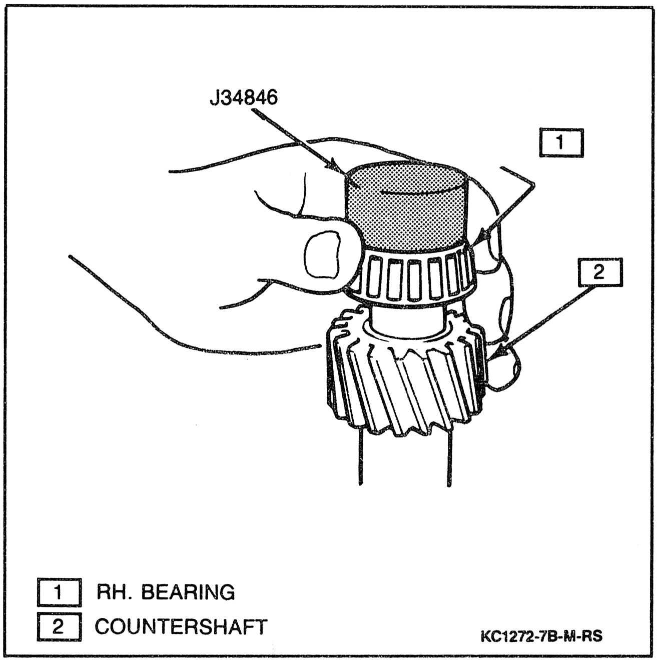

J34846
1
2
1 RH. BEARING
2 COUNTERSHAFT
KC1272-7B-M-RS

Figure 63 RH. Bearing Press-Fit

- Key slot width of 1st synchronizer ring is smaller than that of 2nd synchronizer ring. Distinguish the difference properly.
- Needle bearings for 1st and 2nd gear are identical.

4. Drive in low speed sleeve and hub assembly using J35664 and J34846 (Figure 65).

NOTICE:

- Support shaft with special tool J34846 to keep retainer of bearing free from compression.

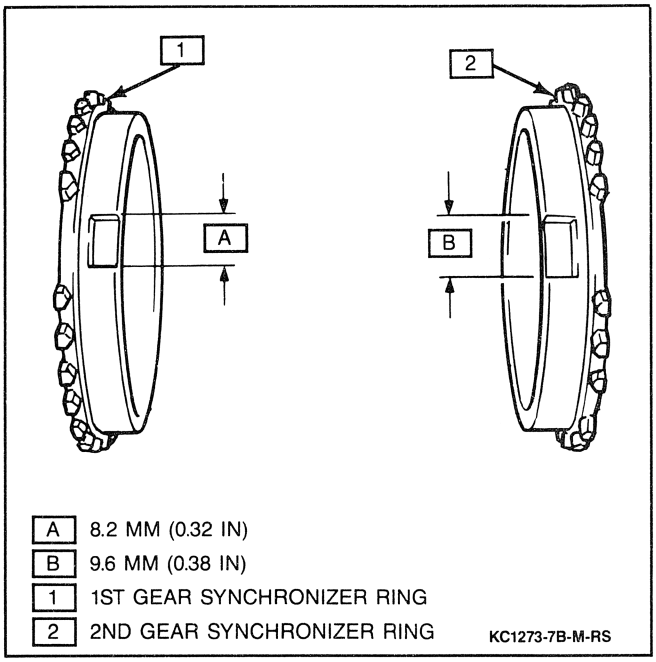

1
2
A
B
A 8.2 MM (0.32 IN)
B 9.6 MM (0.38 IN)
1 1ST GEAR SYNCHRONIZER RING
2 2ND GEAR SYNCHRONIZER RING
KC1273-7B-M-RS

Figure 64 1st and 2nd Ring Difference

- Make sure that synchronizer ring key slots are aligned with keys while press-fitting sleeve and hub assembly.
- Check free rotation of 1st gear after press-fitting sleeve and hub assembly.

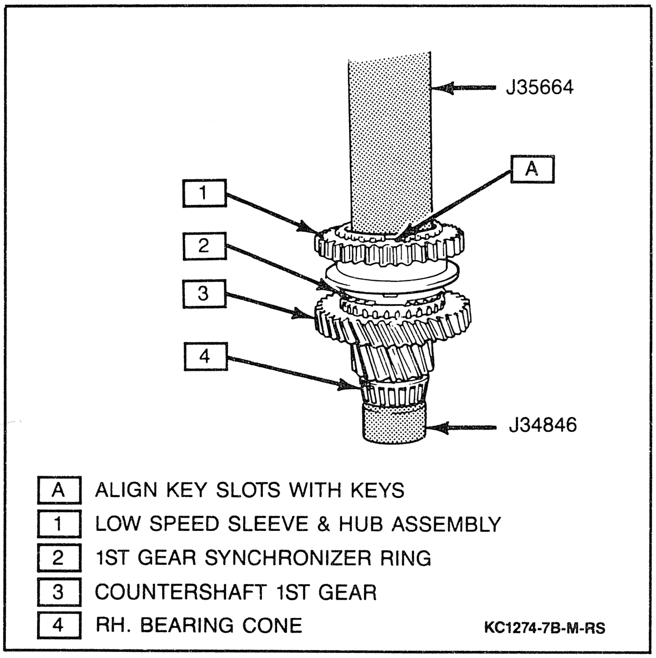

J35664
A
1
2
3
4
J34846
A ALIGN KEY SLOTS WITH KEYS
1 LOW SPEED SLEEVE & HUB ASSEMBLY
2 1ST GEAR SYNCHRONIZER RING
3 COUNTERSHAFT 1ST GEAR
4 RH. BEARING CONE
KC1274-7B-M-RS

Figure 65 Low Speed Sleeve and Hub Press-Fit

5. Snap ring needle bearing, apply oil to bearing, then install 2nd gear synchronizer ring and 2nd gear (Figure 66)

CAUTION: Confirm that snap ring is installed in groove securely.

6. 3rd gear and spacer using J35664 with J37754, J34846 and press (Figure 67).

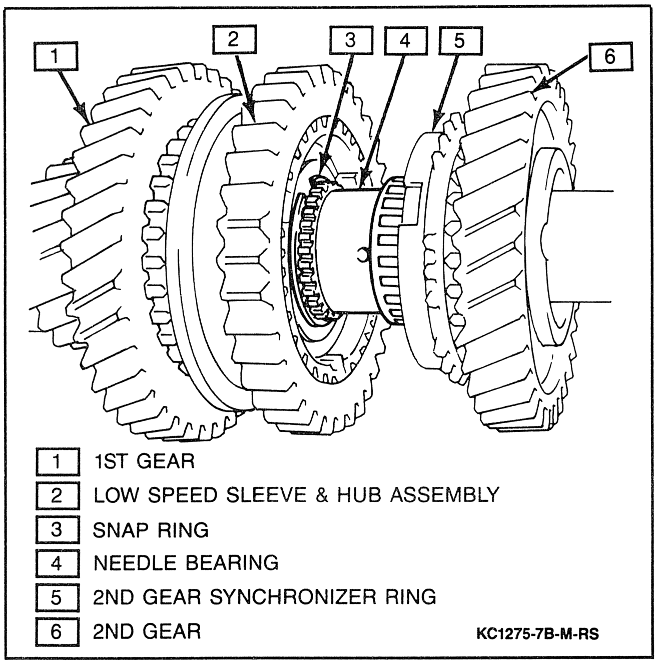

1
2
3
4
5
6
1 1ST GEAR
2 LOW SPEED SLEEVE & HUB ASSEMBLY
3 SNAP RING
4 NEEDLE BEARING
5 2ND GEAR SYNCHRONIZER RING
6 2ND GEAR
KC1275-7B-M-RS

Figure 66 Snap Ring Installation

NOTICE: It is recommended to press-fit spacer and 3rd gear first, then 4th gear separately to prevent counter shaft from being compressed excessively.

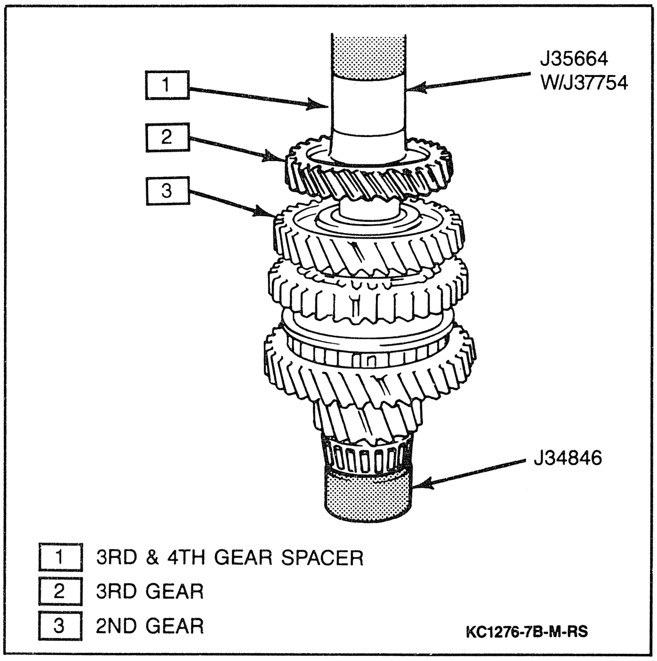

J35664
W/J37754
1
2
3
J34846
1 3RD & 4TH GEAR SPACER
2 3RD GEAR
3 2ND GEAR
KC1276-7B-M-RS

Figure 67 3rd Gear and Spacer Press-Fit

7. 4th gear using J34846 with J37754, J34846 and press.

8. Left bearing using J34844 with J34846 and hammer (Figure 68).

NOTICE: For protection of bearing, always support shaft with special tool J34846.

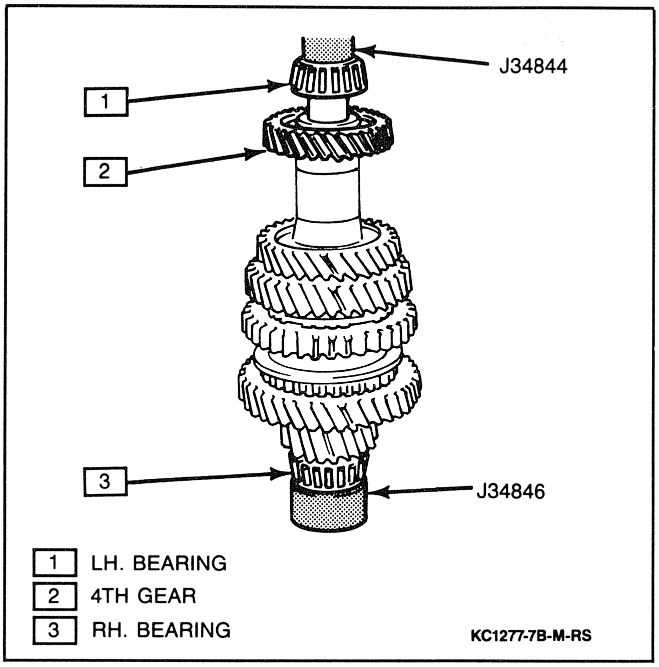

J34844
1
2
3
J34846
1 LH. BEARING
2 4TH GEAR
3 RH. BEARING
KC1277-7B-M-RS

Figure 68 LH. Bearing Press-Fit

Gear Shift and Select Shaft Assembly

Disassemble

1. Component using a standard punch (Figure 69).

Clean

- All components thorougly.

Inspect

- All components and replace with new ones as required.

Assemble

1. Components and install spring pins using hammer and punch (Figure 69).

NOTICE:

- When driving in spring pins, prevent shaft from being bent by supporting it with wood block.
- Assemble 5th and Reverse gear shift cam by winding cam guide return spring, and then drive in spring pin.

High Speed and Low Speed Gear Shift Shafts

Inspect

- Components for abnormal wear or distortion. Use feeler gage for checking clearance A between sleeve and shift fork. Replace component if necessary (Figure 70).

NOTICE: For correct judgement of parts replacement, carefully inspect contact portion of fork and sleeve.

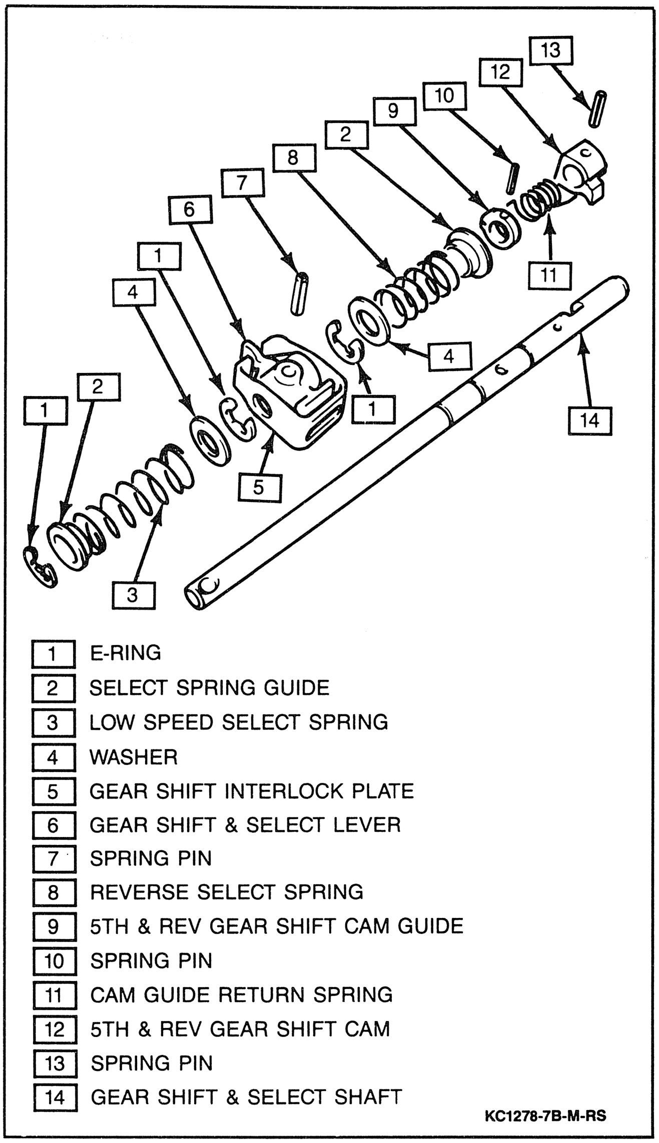

13
12
10
9
2
8
7
6
1
4
11
4
1
2
1
14
5
3
1 E-RING
2 SELECT SPRING GUIDE
3 LOW SPEED SELECT SPRING
4 WASHER
5 GEAR SHIFT INTERLOCK PLATE
6 GEAR SHIFT & SELECT LEVER
7 SPRING PIN
8 REVERSE SELECT SPRING
9 5TH & REV GEAR SHIFT CAM GUIDE
10 SPRING PIN
11 CAM GUIDE RETURN SPRING
12 5TH & REV GEAR SHIFT CAM
13 SPRING PIN
14 GEAR SHIFT & SELECT SHAFT
KC1278-7B-M-RS

Figure 69 Gear Shift and Select Shaft Assembly

- Maximum clearance A is 1.0 mm (0.039 in.).

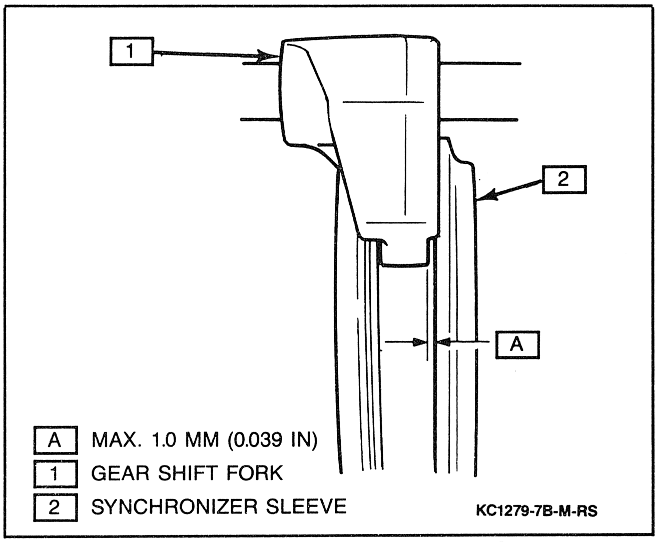

1
2
A
A MAX. 1.0 MM (0.039 IN)
1 GEAR SHIFT FORK
2 SYNCHRONIZER SLEEVE
KC1279-7B-M-RS

Figure 70 Sleeve To Fork Clearance Check

Disassemble

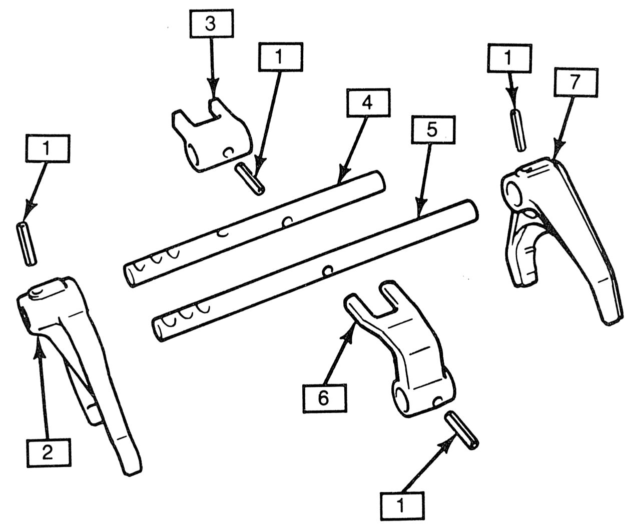
1. Component using standard punch and hammer (Figure 71).

Assemble

1. Shift shafts and drive in spring pins using standard punch (Figure 71).

NOTICE:

- Correct shaft surface using oil stone, if any scratch or dent is found.
- Support shaft with wood blocks when driving in spring pins.



1 SPRING PIN
2 LOW SPEED GEAR SHIFT FORK
3 LOW SPEED GEAR SHIFT YOKE
4 LOW SPEED GEAR SHIFT SHAFT
5 HIGH SPEED GEAR SHIFT SHAFT
6 HIGH SPEED GEAR SHIFT YOKE
7 HIGH SPEED GEAR SHIFT FORK

KC1280-7B-M-RS

Figure 71 Low and High Speed Shifter Assembly

5th and Reverse Gear Shifter

Disassemble

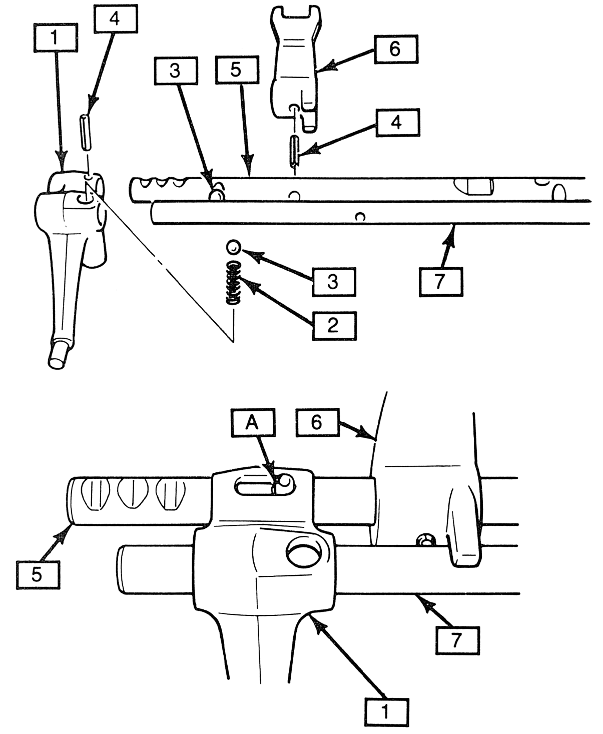
1. Component using standard punch and hammer (Figure 72).
2. Replace or correct parts as required.

Assemble

1. Shafts making sure that components are in proper order (Figure 72).
2. Drive in spring pins using standard punch and hammer.

NOTICE:

- Distinguish reverse gear shift arm spring (Blue) from low speed locating spring (Purple).
- Install two steel balls in reverse gear shift arm without fail.
- Drive in spring pin for reverse shift arm facing slit A toward front.



A FACE PIN SLIT TOWARD FRONT
1 REVERSE GEAR SHIFT ARM
2 REVERSE GEAR SHIFT ARM SPRING
3 STEEL BALL
4 SPRING PIN
5 5TH & REV GEAR SHIFT SHAFT
6 5TH & REV GEAR SHIFT YOKE
7 5TH & REV GEAR SHIFT GUIDE SHAFT

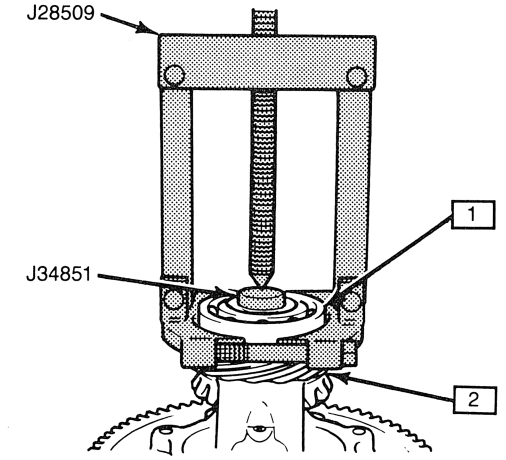
KC1281-7B-M-RS

Figure 72 5th and Reverse Shifter Assembly

Differential Assembly

Remove or Disconnect

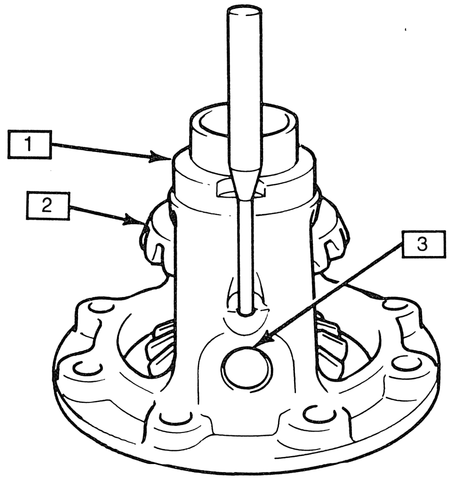
1. Right bearing using J28509.
2. Speedometer drive gear.
3. Left bearing using J28509 with J34851 (Figure 73).
4. Eight final gear bolts, then final gear while supporting differential case with soft jawed vise.
5. Drive out differential side pinion shaft roll pin using standard punch and hammer then disassemble component parts (Figure 74).



1 RH. BEARING
2 SPEEDOMETER DRIVE GEAR

KC1282-7B-M-RS

Figure 73 LH. Differential Side Bearing Removal



1 DIFFERENTIAL CASE
2 DIFFERENTIAL GEAR
3 DIFFERENTIAL PINION SHAFT

KC1283-7B-M-RS

Figure 74 Roll Pin Removal

Inspect

- Abnormality before disassembly and after disassembly. Replace components if necessary.

Install or Connect

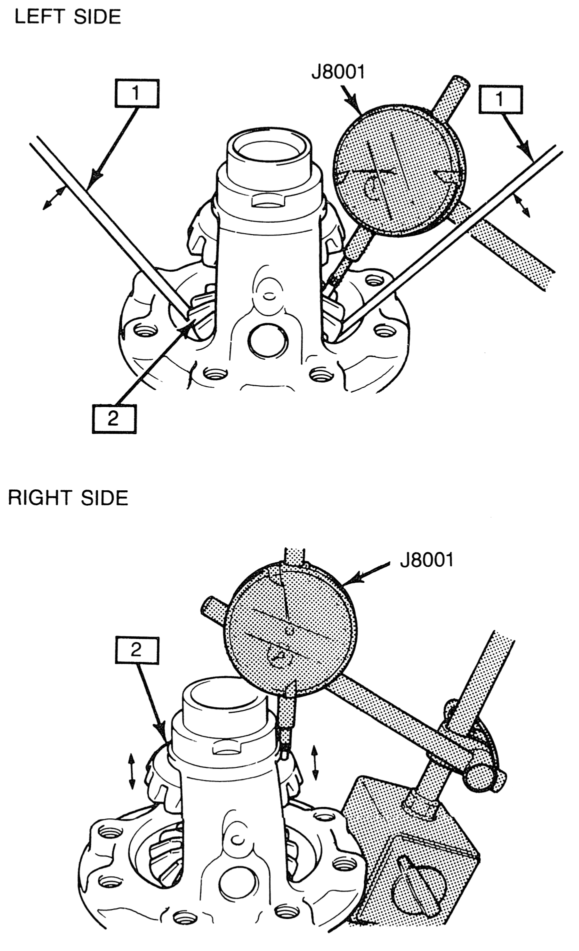
1. Differential gear and measure thrust play of differential gear as follows (Figure 75).

Left Side

- Hold differential assembly with a soft jawed vise and apply measuring tip of dial gage to top surface of gear.
- Using two screwdrivers, move gear up and down and read movement of dial gage pointer. Thrust play should be between 0.05 - 0.33 mm (0.002 -0. 013 in.).

Right side

- Using a similer procedure to the above, set dial gage tip to gear shoulder.
- Move gear up and down by hand and read dial gage. Thrust play should be between 0.05 - 0.33 mm (0.002 - 0.013 in.).



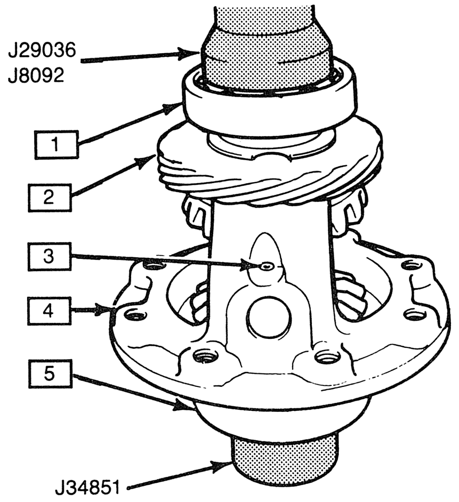
1 SCREWDRIVER
2 DIFFERENTIAL GEAR

KC1284-7B-M-RS

Figure 75 Gear Thrust Play Measurement

NOTICE: If thrust play is out of specification, select suitable thrust washer from following available sizes, install washer and check again that specified gear play is obtained.

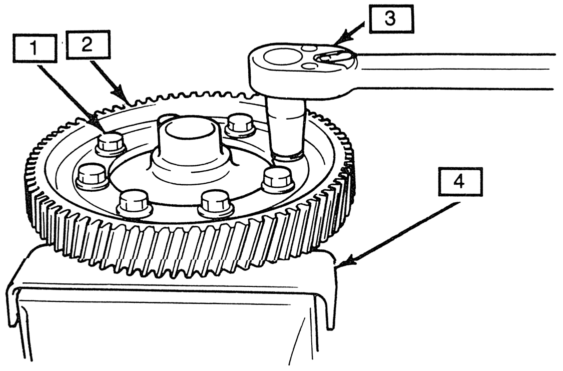
2. Drive in spring pin from right side till it is flush with differential case surface.
3. Left bearing using J34851 and hammer.
4. Speedometer drive gear, support differential assembly to allow LH. bearing to float and then press-fit RH. bearing using J29036 with J8092 and hammer (Figure 76).



1 DIFFERENTIAL SIDE RH. BEARING
2 SPEEDOMETER DRIVE GEAR
3 DIFFERENTIAL SIDE PINION SHAFT PIN
4 DIFFERENTIAL CASE
5 DIFFERENTIAL SIDE LH. BEARING

KC1285-7B-M-RS

Figure 76 Differential Side Bearing Press-Fit



1 RING GEAR BOLT
2 RING GEAR
3 TORQUE WRENCH
4 SOFT JAWED VISE

KC1286-7B-M-RS

Figure 77 Ring Gear Bolts

5. Ring gear while holding differential assembly with soft jawed vise, install eight final gear bolts (Figure 77).

CAUTION: Use of any other bolts than specified one is prohibited.

Tighten

- Ring gear bolts to 85 N·m (63.0 lb.ft.).

ASSEMBLING TRANSAXLE

Install or Connect

NOTICE: Input shaft RH. bearing can be installed into right case by tapping shaft with J34849 and plastic hammer.

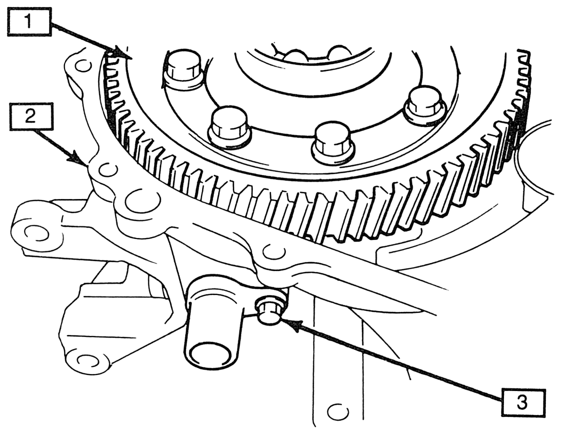
1. Differential assembly into right case using rubber hammer to drive flush with case (Figure).
2. Insert speedometer driven gear case assembly applied with oil to its O-ring and gear, then tighten it with bolt.

CAUTION:

- While inserting case assembly into transmission, turn final gear by hand slightly so that gear can mesh easily.
- Never push or hit slit portion of case when inserting it. Such attempt may cause case to break.

Tighten

- Case bolt to 6 N·m (4.0 lb. ft.)



1 DIFFERENTIAL ASSEMBLY
2 TRANSMISSION RIGHT CASE
3 SPEEDOMETER DRIVEN GEAR CASE BOLT

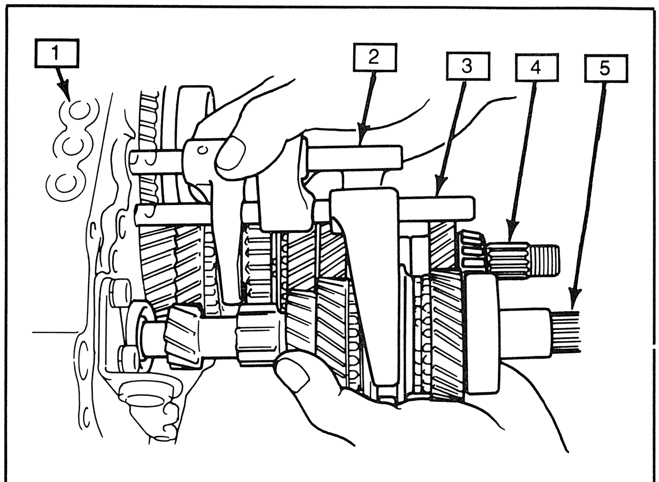
KC1287-7B-M-RS

Figure 78 Differential Assembly Installation

3. Input shaft, countershaft, low speed gear shift shaft assemblies all together; then install them into right case (Figure 79).

NOTICE: Check to make sure that counter shaft is engaged with final gear while installing.

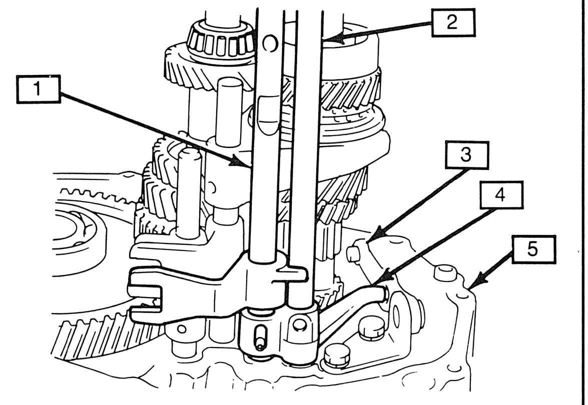
4. 5th and reverse gear shift shaft with 5th and reverse gear shift guide shaft into right case Reverse gear shift arm has to be joined with reverse gear shift lever at the same time (Figure 80).
5. Reverse idler gear with reverse gear shift lever, insert reverse gear shaft into case through idler



1	RIGHT CASE
2	LOW SPEED GEAR SHIFT SHAFT
3	HIGH SPEED GEAR SHIFT SHAFT
4	COUNTERSHAFT ASSEMBLY
5	INPUT SHAFT ASSEMBLY

KC1288-7B-M-RS

Figure 79 Input Shaft and Countershaft



1	5TH & REV GEAR SHIFT SHAFT
2	5TH & REV GEAR SHIFT GUIDE SHAFT
3	REVERSE GEAR SHIFT LEVER
4	REVERSE GEAR SHIFT ARM
5	RIGHT CASE

KC1289-7B-M-RS

Figure 80 5th and Reverse Shifter Installation

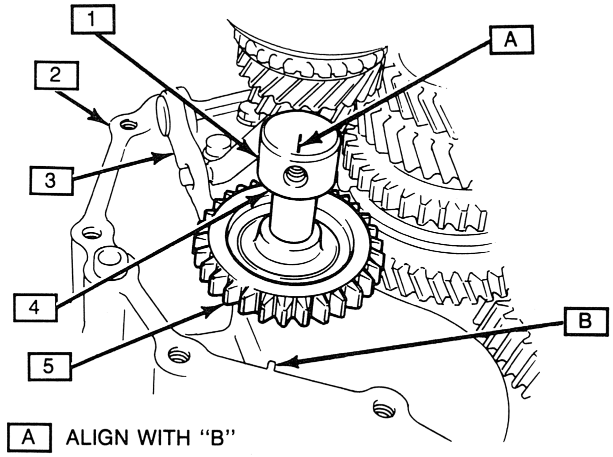
gear and then align A in shaft with B in case (Figure 81).

NOTICE:

- Make sure that washer has been installed in shaft above the gear.
- Check to confirm that reverse gear shift lever end has clearance 1 mm (0.04 in.) to idler gear groove.

Clean

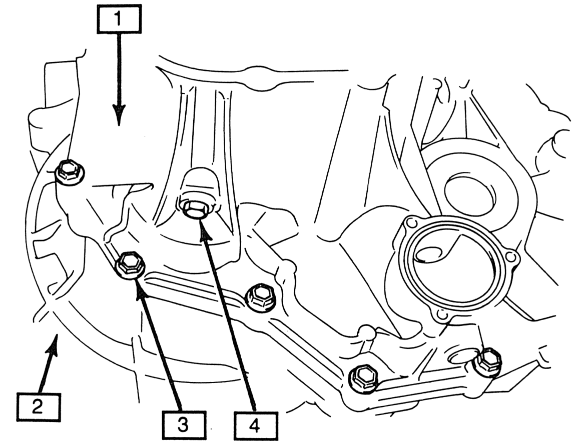
- Mating surfaces of both right and left cases.



A	ALIGN WITH "B"
1	REVERSE GEAR SHAFT
2	RIGHT CASE
3	REVERSE GEAR SHIFT LEVER
4	WASHER
5	REVERSE IDLER GEAR

KC1290-7B-M-RS

Figure 81 Reverse Gear Shaft Alignment



1	LEFT CASE (COAT MATING SURFACE WITH SEALER #1052751)
2	RIGHT CASE
3	CASE BOLT
4	REVERSE SHAFT BOLT

KC1291-7B-M-RS

Figure 82 Case Bolts

6. Coat mating surface of left case with sealant #102751 evenly then mate it with right case. Use rubber hammer if necessary.
7. Eleven case bolts outside (Figure 82).
8. Reverse shaft bolt with aluminum washer (Figure 82).

Tighten

- Case bolt to 19 N•m (14.0 lb.ft.).
- Reverse shaft bolt to 14 N•m (10.0 lb.ft.).

9. Two case bolts from clutch housing side and tighten them to specification.

Tighten

- Case bolts to 19 N·m (14.0 lb.ft.).

Inspect

- Locating springs for deterioration and replace with new ones as necessary.

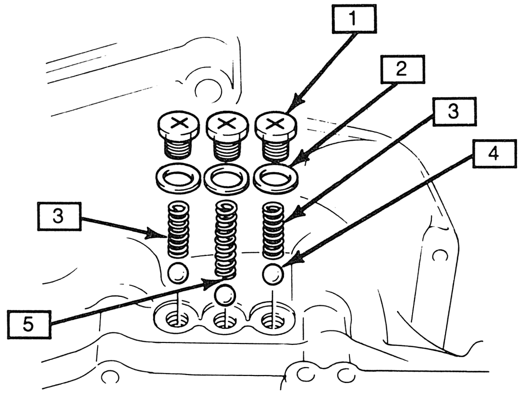
10. Steel ball and locating spring for respective gear shift shaft and tighten with bolt.

NOTICE: Springs are color coded. Be sure to place springs in the correct position (Figure 83).

- Low speed sprng standard length 26.1 mm (1.028 in.)
- Low speed spring service limit 25.0 mm (0. 984 in.).
- High speed spring standard length 40.1 mm (1.579 in.).
- High speed service limit 39.0 mm (1.535 in.).

Tighten

- Gear shift fork shaft bolts to 13 N·m (10.0 lb.ft.).



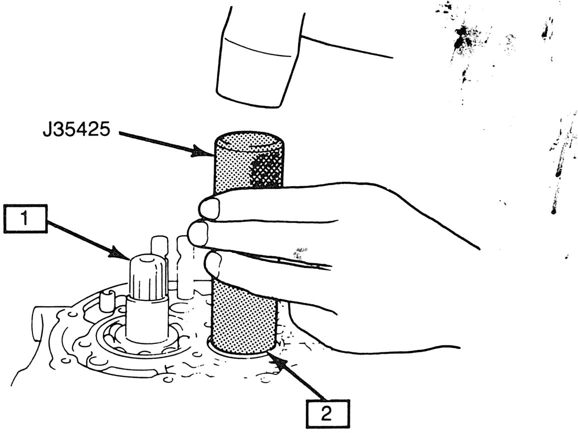
1 GEAR SHIFT FORK SHAFT BOLT
2 WASHER
3 LOW SPEED LOCATING SPRING
4 STEEL BALL
5 HIGH SPEED LOCATING SPRING

KC1292-7B-M-RS

Figure 83 Locating Spring Installation

11. Counter shaft LH. bearing race to bearing using J35425 and plastic hammer.
12. Select a suitable shim which adjusts clearance A to specification then install it onto bearing race. Use the following procedure to determine the shim: Place shim on the bearing race, then place straight edge flat bar over it and compress. Measure A (Clearance between case surface and straight edge) by using feeler gage (Figure 85).

NOTICE: Insert 0.1 mm (0.004 in.) feeler to quickly determine whether or not a shim fulfills specification.

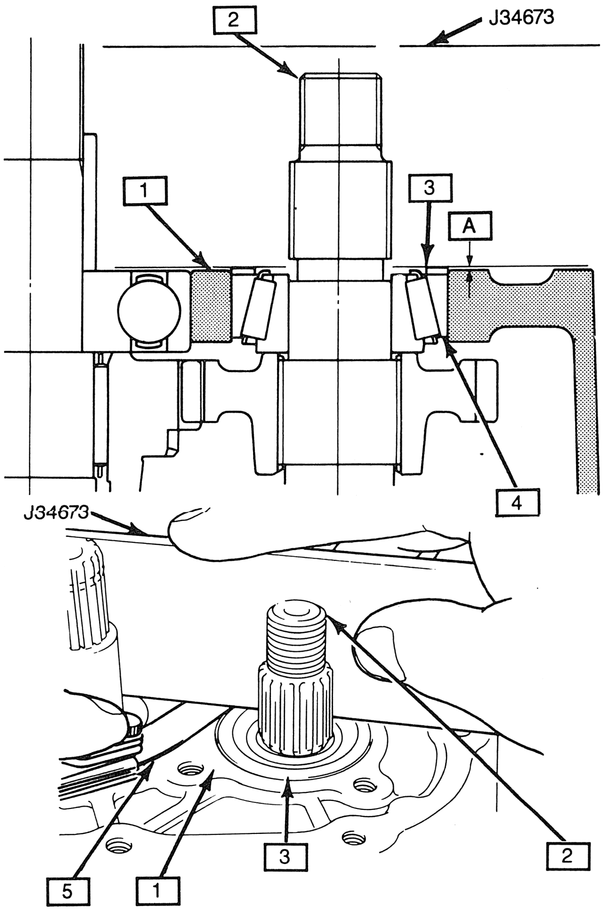


1 INPUT SHAFT
2 LH. BEARING RACE

KC1293-7B-M-RS

Figure 84 Counter Shaft LH. Bearing Race Seat

- Clearance A shim protrusion 0.08 - 0.12 mm (0.0032 - 0.0047 in.).



A SHIM PROTRUSION
1 CASE SURFACE
2 COUNTERSHAFT
3 BEARING SET SHIM
4 BEARING CUP
5 FEELER GAGE

KC1294-7B-M-RS

Figure 85 Bearing Set Shim Selection

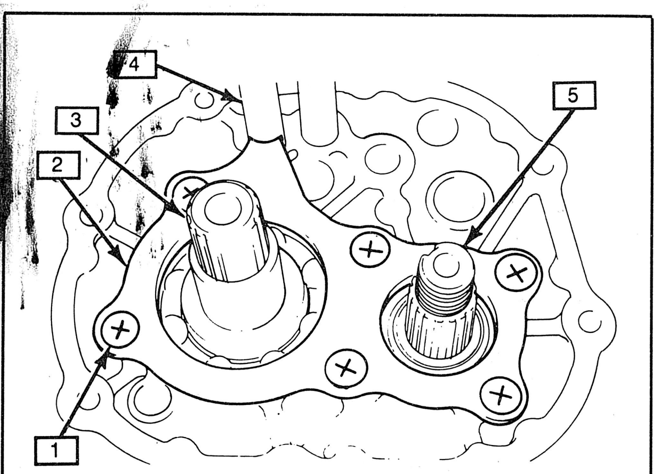

4
5
3
2
1
1 SCREW (APPLY LOCTITE #1052624)
2 LEFT CASE PLATE
3 INPUT SHAFT
4 5TH & REV GEAR SHIFT GUIDE SHAFT
5 COUNTERSHAFT
KC1295-7B-M-RS

Figure 86 Left Case Plate

13. Left case plate by inserting its end in groove of shift guide shaft, then tighten it with six screws applied with loctite #1052624 (Figure 86).

Tighten

- Left case plate to 7 N·m (5.0 lb.ft.)

NOTICE: After tightening screws make sure that counter shaft can be rotated by hand.

14. 5th speed synchronizer sleeve and hub with keys and springs (Figure 87).

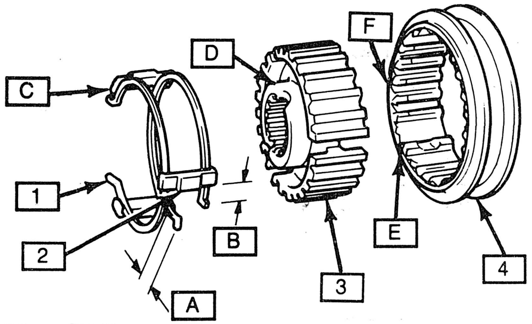

C
D
F
1
2
B
E
3
4
A
A = B
C SHORT SIDE (INWARD)
D LONG BOSS (INWARD)
E KEY WAY
F CHAMFERED SPLINE (INWARD)
1 5TH SPEED SYNCHRONIZER SPRING
2 KEY
3 HUB
4 SLEEVE
KC1296-7B-M-RS

Figure 87 5th Speed Synchronizer Assembly

NOTICE: Short side C in keys, long boss D in hub and chamfered spline F in sleeve should face inward (5th gear side).

15. 5th gear to counter shaft facing machined boss A inward (Figure 88).
16. Needle bearing to input shaft, apply oil, install 5th gear and J35309 to stop shaft rotation
17. Counter shaft nut (Figure 89).

Tighten

- Counter shaft nut to 70 N·m (52.0 lb.ft.).

18. Remove tool J35309 then stake nut at C with drift and hammer (Figure 90).
19. Synchronizer ring then ring spring.
20. 5th gear shift fork to sleeve and hub assembly then install them into input shaft, 1 shift shaft and shift guide shaft all at once aligning hub oil groove A with shaft mark B (Figure 90).

NOTICE: Long boss of hub faces inward (gear side).

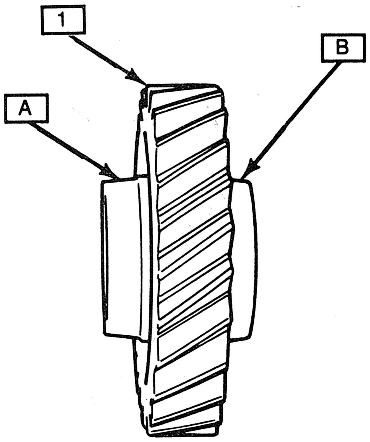

1
B
A
A MACHINED BOSS (INSIDE)
B NO MACHINING (OUTSIDE)
1 COUNTERSHAFT 5TH GEAR
KC1297-7B-M-RS

Figure 88 Counter Shaft 5th Gear

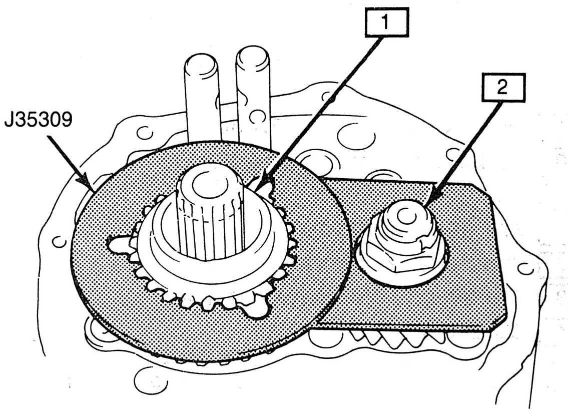

1
2
J35309
1 INPUT SHAFT 5TH GEAR
2 COUNTERSHAFT NUT
KC1298-7B-M-RS

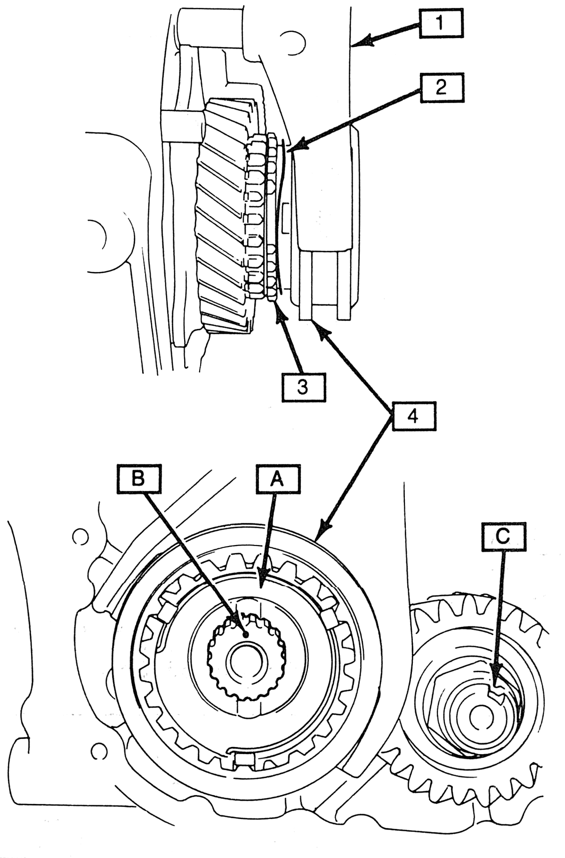
Figure 89 Counter Shaft Nut

CAUTION: Be careful not to pinch synchronizer ring spring by hub.

21. Drive in roll pin facing its slit A outward (Figure 91).
22. Steel ball, tighten shift fork plug applied with loctite # 1052624.
23. Hub plate and fix it with snap ring (Figure 91).

CAUTION:

- Coat shift fork plug with loctite # 1052624 lightly. Excess may interfere in ball movement and cause hard shift to 5th speed.
- Make sure snap ring is installed in shaft groove securely.
- Shift fork plug to 13 N•m (10.0 lb.ft.).



A OIL GROOVE (ALIGN WITH B)
B PUNCH MARK (SHOWS OIL HOLE)
C STAKE
1 5TH GEAR SHIFT FORK
2 SYNCHRONIZER RING SPRING
3 5TH SPEED SYNCHRONIZER RING
4 SLEEVE & HUB ASSEMBLY

KC1299-7B-M-RS

Figure 90 5th Speed Sleeve and Hub Installation

Clean

- Mating surface of both left case and left cover.

24. Coat mating surface A with sealant #1052751 evenly, mate it with left case then tighten with eight bolts (Figure 92).

Tighten

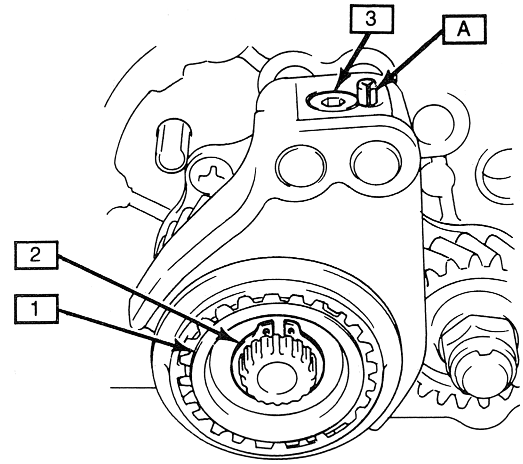
- Left cover bolts to 10 N•m (7.0 lb.ft.).

25. If gear shift guide case has been disassembled or replaced, tighten bolts as specified below. Also air check breather hole A (Figure 93).

Tighten

- Gear shift case plate bolt to 6 N•m (4.0 lb. ft.).
- 5th to reverse interlock guide bolt to 23 N•m (17.0 lb.ft.).

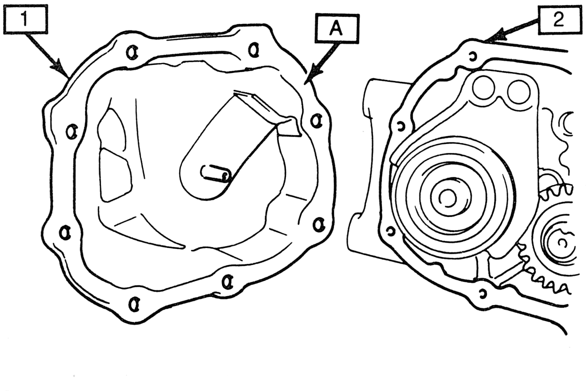
26. Clean mating surface of guide case and coat it with sealant evenly (Figure 93).
27. Gear shift yoke and join it with gear shift arm.



A ROLL PIN (FACE OUTWARD)
1 HUB PLATE
2 SNAP RING
3 SHIFT FORK PLUG

KC1300-7B-M-RS

Figure 91 Snap Ring/Roll Pin Installation



A APPLY SEALANT #1052751
1 LEFT COVER
2 LEFT CASE

KC1301-7B-M-RS

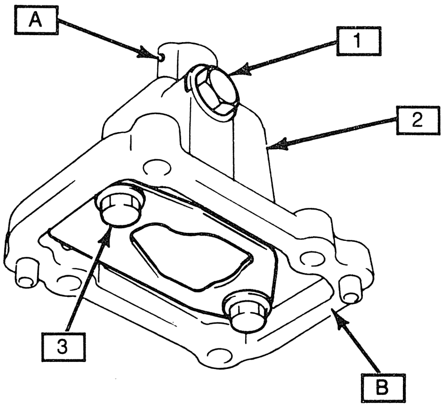
Figure 92 Side Cover Installation

28. Gear shift and select shaft assembly into transaxle and join its bottom end with gear shift yoke (Figure 94).
29. Tighten yoke and shaft with bolt coated with loctite # 1052624 (Figure 94).
30. Gear shift interlock bolt with washer.

NOTICE: When installing gear shift and select shaft assembly, position gear in neutral so that gear shift interlock plate will go in smoothly.

Tighten

- Gear shift yoke bolt to 23 N·m (17.0 lb.ft.).
- Gear shift interlock bolt to 23 N·m (19.0 lb. ft.).



A	BREATHER (AIR BLOW)
B	APPLY SEALANT #1052751
1	5TH TO REV INTERLOCK GUIDE BOLT
2	GEAR SHIFT GUIDE CASE
3	GEAR SHIFT CASE PLATE BOLT

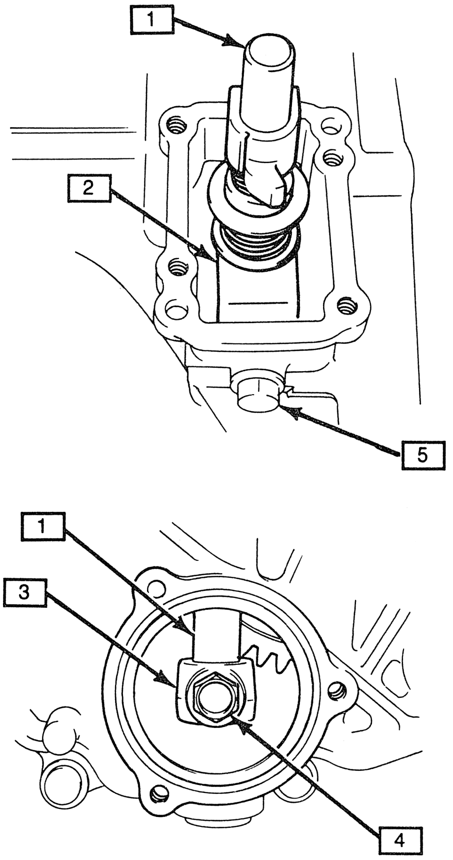
KC1302-7B-M-RS

Figure 93 Gear Shift Guide Case Assembly

31. Clean mating surface of left case and put gear shift guide case applied with sealant on it.
32. Wiring harness clamp and after applying sealant #1052751 bracket and fasten it together with gear shift guide case (Figure 95).
33. Backup lamp switch and clamp its lead (Figure 95).
34. Clean left case cap and mating surface of left case, check condition of ring and then fasten cap with three bolts (Figure 95).

Tighten

- Gear shift guide case bolts ot 10 N·m (7.0 lb.ft.)
- Left case cap bolts to 10 N·m (7.0 lb.ft.).
- Backup lamp switch to 20 N·m (15.0 lb. ft.).



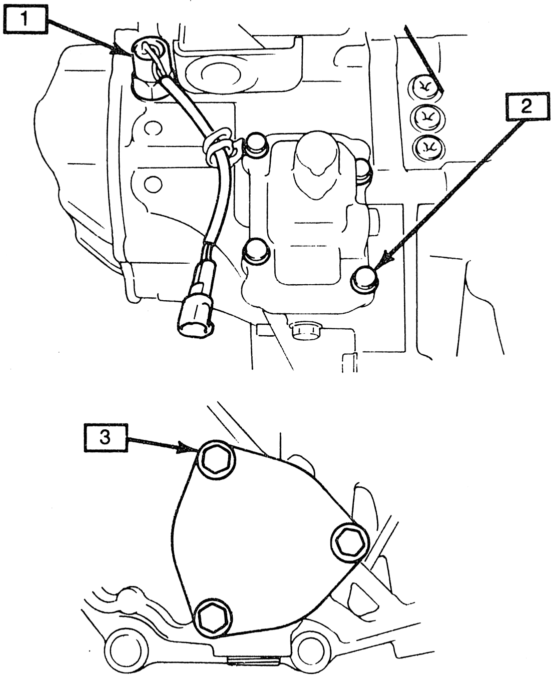
1	GEAR SHIFT & SELECT SHAFT ASSEMBLY
2	GEAR SHIFT INTERLOCK PLATE
3	GEAR SHIFT YOKE
4	BOLT
5	GEAR SHIFT INTERLOCK BOLT

KC1303-7B-M-RS

Figure 94 Gear Shift and Select Shaft

Inspect

- Input shaft for rotation in each gear position.
- Function of backup lamp switch in reverse position by using ohmmeter.



1 BACKUP LAMP SWITCH
2 GEAR SHIFT GUIDE CASE BOLT
3 LEFT CASE CAP BOLT

KC1304-7B-M-RS

Figure 95 Gear Shift Guide Case Installation

TORQUE SPECIFICATIONS

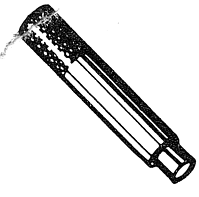
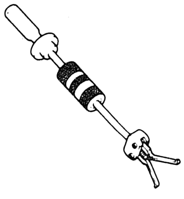
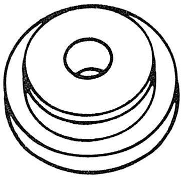
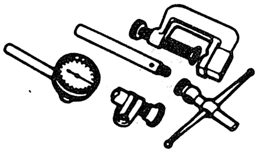
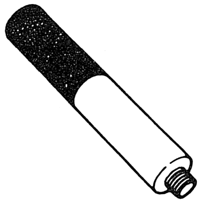
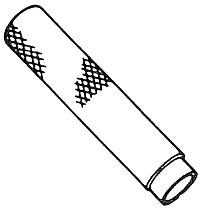
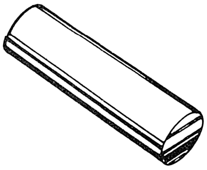
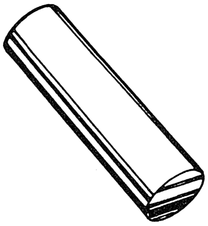
Specifications Torque

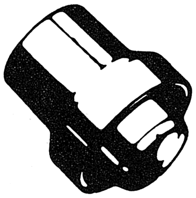
Oil Filler/Level Plug	45 N·m (33.0 lb.ft.)
Oil Drain Plug	28 N·m (21.0 lb.ft)
Ball Stud Bolt And Nut	60 N·m (44.0 lb.ft.)
Gear Shift Control Housing Nuts For Boot Cover	5 N·m (4.0 lb.ft.)
Housing Nuts For Control Housing	18 N·m (13.0 lb.ft.)
Guide Plate Bolts	9 N·m (7.0 lb.ft.)
Control Housing Nuts	33 N·m (24.0 lb.ft.)
Extension Rod Stud Bolt	18 N·m (13.0 lb.ft.)
Extension Rod Nut	33 N·m (24 lb.ft.)
Gear Shift Control Shaft Bolts And Nuts	18 N·m (13.0 lb.ft.)
Speedometer Driven Gear Case Bolt	6 N·m (4.0 lb.ft.)
Transmission To Engine Bolts And Nuts	50 N·m (37.0 lb.ft.)
Engine Mounting Nuts	50 N·m (37.0 lb.ft.)
Engine Mounting LH Bracket Bolts	50 N·m (37.0 lb.ft.)
Exhaust Pipe to Manifold Bolts	50 N·m (37.0 lb.ft.)
Exhaust Pipe to Muffler Nuts	50 N·m (37.0 lb.ft.)
Extension Rod Nut	33 N·m (24.0 lb.ft.)
Reverse Gear Shift Lever bolts	23 N·m (17.0 lb.ft.)
Gear Shift Arm Bolts	23 N·m (17.0 lb.ft.)
Oil Gutter Bolt	6 N·m (4.0 lb.ft.)
Final Gear Bolts	85 N·m (63 lb.ft.)
Transmission Case Bolts	19 N·m 14.0 lb.ft.)
Reverse Shaft Bolt	14 N·m (14.0 lb.ft.)
Gear Shift Fork Shaft Bolts	13 N·m (10.0 lb.ft.)
Left Case Plate Screws	7 N·m (5.0 lb.ft.)
Counter Shaft Nut	70 N·m (52 lb.ft.)
5th Shift Fork Plug	13 N·m (10.0 lb.ft.)
Left Cover Bolts	10 N·m (7.0 lb.ft)
Gear Shift Case Plate Bolt	6 N·m (4.0 lb.ft.)
5th to Reverse Interlock Guide Case Bolts	23 N·m (17.0 lb.ft.)
Gear Shift Yoke Bolt	23 N·m (17.0 lb.ft.)
Gear Shift Interlock Bolt	23 N·m (17.0 lb.ft.)
Gear Shift Guide Case Bolts	10 N·m (7.0 lb.ft.)
Left Case Cap Bolts	10 N·m (7.0 lb.ft.)
Backup lamp switch	20 N·m (15.0 lb.ft.)

SERVICE MATERIALS

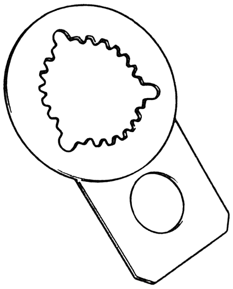
MATERIAL	RECOMMENDED GM PRODUCT	USE
Lubriplate	GM # 1052169	• Oil seal lips • Gear shift control lever • Gear shift control shaft bushes
Silicon Sealer	GM # 1052751	• Oil drain plug • Gear shift shaft bolt • Mating surface of transmission case • Mating surface of side cover • Mating surface of gear shift guide case
Loctite	GM # 1052624	• Control lever knob • Reverse gear shift lever bolts • Oil gutter bolt screws • Gear shift yoke bolt

SPECIALS TOOLS

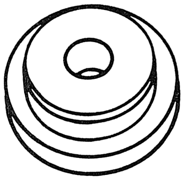
 J7079-2 NON-THREADED UNIVERSAL DRIVER HANDLE	 J23907 SLIDE HAMMER	 J34851 DIFFERENTIAL SIDE BEARING PULLER ATTACHMENT	 J8001 DIAL INDICATOR SET
 J8092 DRIVER HANDLE	 J34844 TRANSAXLE SHAFT BEARING INSTALLER	 J35664 PINION SHAFT BEARING INSTALLER	 J35283 INPUT GEAR BEARING INSTALLER KC1305-7B-M-RS



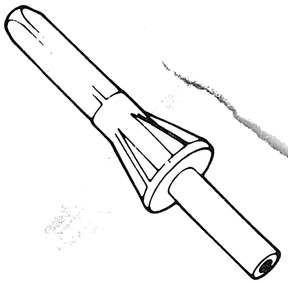
J29130
RIGHT HAND AXLE SHAFT
SEAL INSTALLER



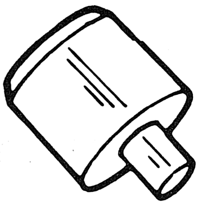
J35309
LOCKNUT WRENCH



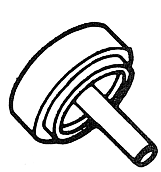
J34851
DIFFERENTIAL SIDE
BEARING PULLER
ATTACHMENT



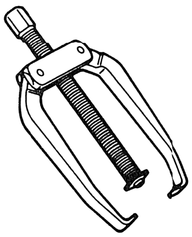
J34857
GEAR SHIFT SHAFT SEAL
INSTALLER



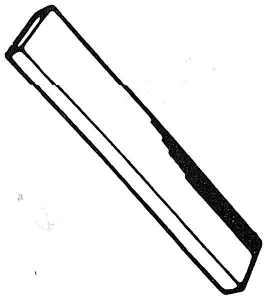
J34848
CLUTCH PILOT BEARING
INSTALLER



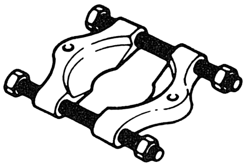
J34846
COUNTERSHAFT BEARING
INSTALLER



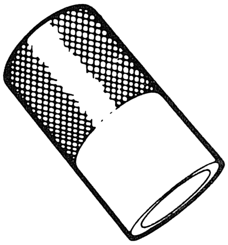
J28509-A
CRANKSHAFT
SPROCKET REMOVER



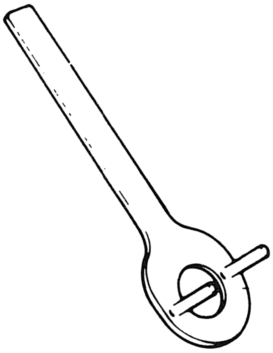
J34673
FLAT GAGE BAR



J22912-01
BEARING
PULLER



J35425
MANUAL RACK SEAL
INSTALLER/POWER RACK
PINION BEARING AND
SEAL INSTALLER (All)



J34836
CAMSHAFT SPROCKET
HOLDER

KC1306-7B-M-RS

SECTION 7C

CLUTCH

CAUTION: When servicing clutch parts, do not create dust by grinding or sanding clutch disc or by cleaning parts with a dry brush or with compressed air. (A water dampened cloth - NOT SOAKED - should be used). The clutch disc contains asbesto fibers which can become airborne if dust is created during servicing. Breathing dust containing asbesto fibers may cause serious bodily harm.

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GENERAL DESCRIPTION

The clutch is a diaphragm-spring clutch of a dry single disc type. The diaphragm spring is of a tapering-finger type, which is a solid ring in the outer diameter part, with a series of tapering fingers pointing inward.

The disc, carrying four torsional coil springs, is positioned on the transaxle input shaft with a serration fit.

The clutch cover is secured to the flywheel, and carries the diaphragm spring in such a way that the peripheral edge part of the spring pushes on the pressure plate against the flywheel (with the disc in between), when the clutch release bearing is held back.

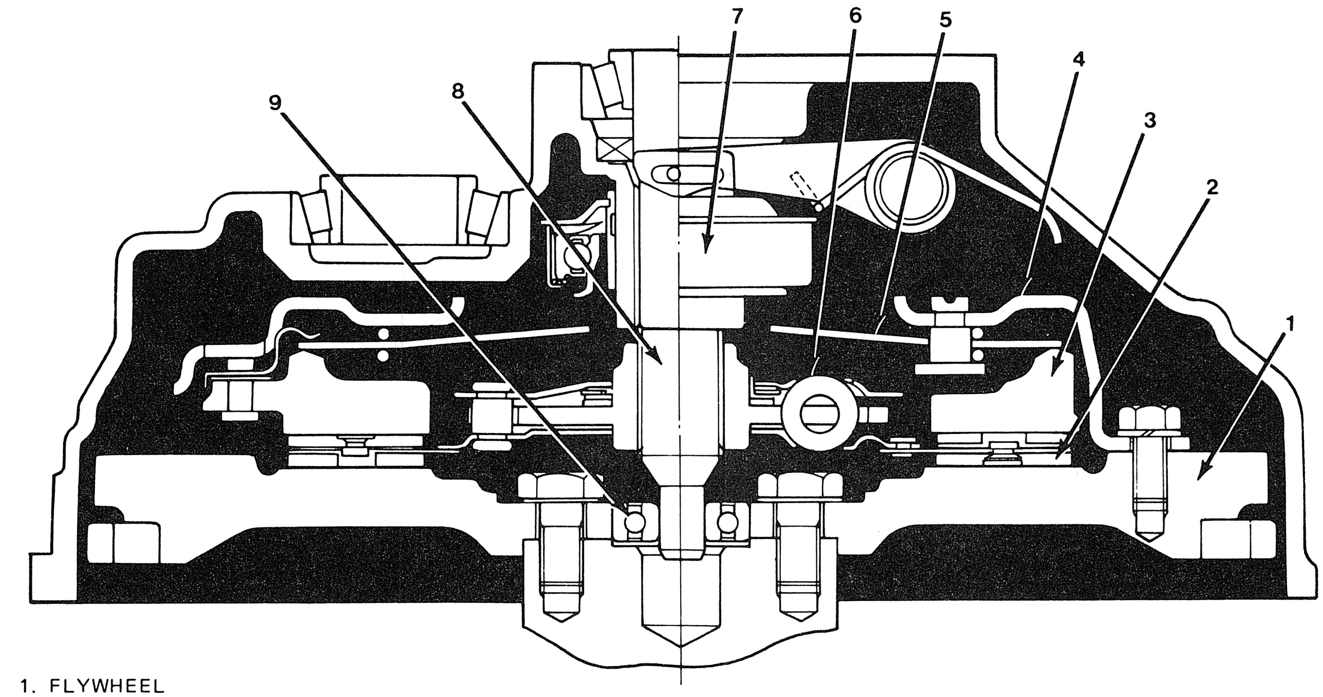
This is the engaged condition of the clutch.

Depressing the clutch pedal causes the release bearing to advance and pushes on the tips of the tapering fingers of the diaphgram spring.

When this happens, the diaphragm spring pulls the pressure plate away from the flywheel, thereby interrupting the flow of drive from flywheel through clutch disc to transaxle input shaft.

The clutch start switch is mounted above clutch pedal. This switch is in the electric circuit of starter motor, and operates according to movement of clutch pedal. When starting engine, the clutch pedal should be fully depressed in order to turn on this switch.

If the clutch pedal is released or is not depressed all the way, this switch is "OFF" and the starter motor will not run even if the ignition key is in the "START" position. Refer to Figure 5 for the clutch start switch.



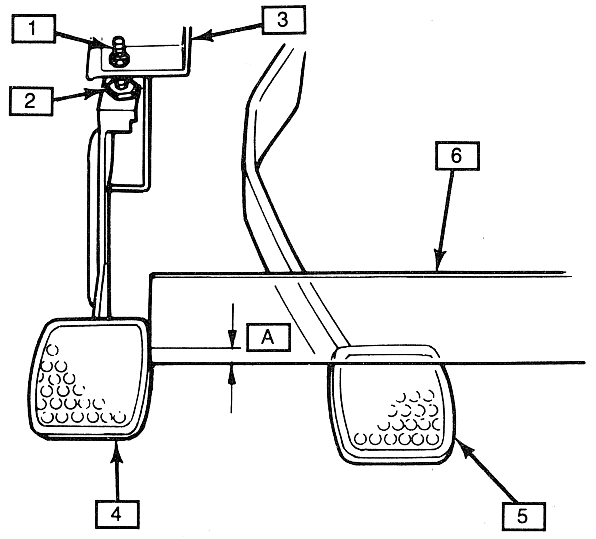
1. FLYWHEEL
2. CLUTCH DISC
3. PRESSURE PLATE
4. CLUTCH COVER
5. DIAPHRAGM SPRING
6. TORSIONAL COIL SPRING
7. CLUTCH RELEASE BEARING
8. INPUT SHAFT
9. PILOT BEARING

Figure 1 Clutch Cross Section

DIAGNOSIS

Condition	Possible Cause	Correction
Slipping	● Improper clutch pedal free travel.	Adjust free travel.
	● Worn or oily clutch disc facing.	Replace disc.
	● Warped disc or pressure plate.	Replace disc or clutch cover.
	● Weak diaphragm spring.	Replace clutch cover.
Grabbing (Chattering)	● Worn or oily clutch disc facing.	Replace disc.
	● Warped disc or pressure plate.	Replace clutch cover or disc.
	● Loose engine mounts.	Tighten or replace mounts.
	● Weak torsion springs.	Replace disc.
Noisy	● Worn release bearing.	Replace release bearing.
	● Dry clutch cable.	Replace or grease.

ON VEHICLE SERVICE



A HEIGHT DIFFERENCE 8 MM (0.3 IN.)
1 ADJUST BOLT
2 LOCK NUT
3 PEDAL BRACKET
4 CLUTCH PEDAL
5 BRAKE PEDAL
6 MEASURE

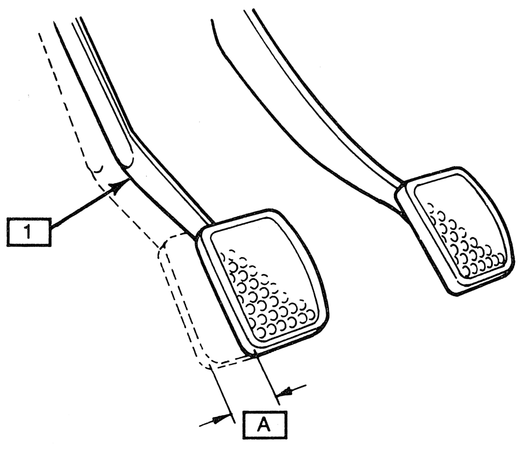
KC1315-7C-M-RS

Figure 2 Pedal Height Adj.

CLUTCH PEDAL HEIGHT (FIGURE 2)

Adjustment

Adjust the height of the clutch pedal with the clutch pedal stop bolt, so that the pedal is level with the brake pedal. Tighten the lock nut after adjusting.



A FREE TRAVEL 15–20 MM (0.6–0.8 IN.)
1 CLUTCH PEDAL

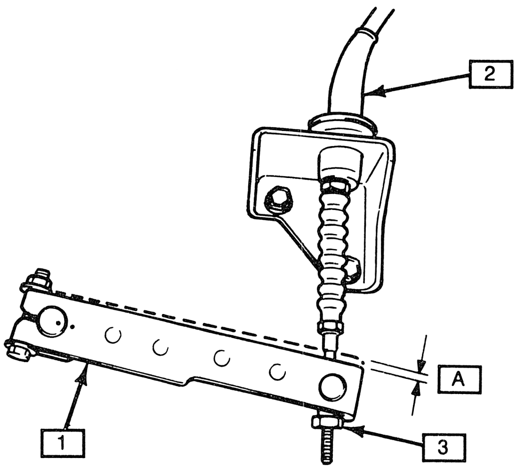
KC1316-7C-M-RS

Figure 3 Clutch Pedal Free Travel Check

CLUTCH RELEASE ARM PLAY

Adjustment

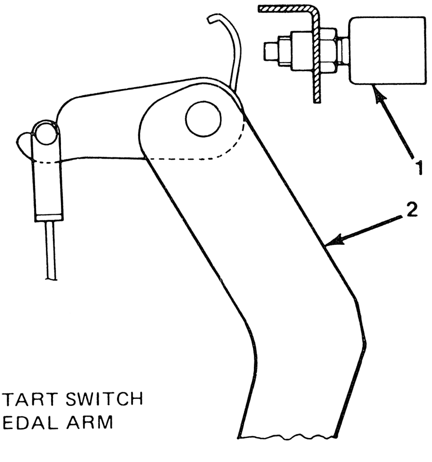
1. Depress clutch pedal, stop when resistance is felt. Measure distance "A", travel should be within 15-20 mm (0.6-0.8 in.) (Figure 3).
2. If the travel is out of specification, loosen or tighten the clutch cable joint nut as necessary (Figure 4).



A FREE TRAVEL 2–4 MM (0.08–0.15 IN.)
1 RELEASE LEVER
2 CLUTCH CABLE
3 JOINT NUT

KC1317-7C-M-RS

Figure 4 Clutch Arm Free Travel Adj.



1. CLUTCH START SWITCH
2. CLUTCH PEDAL ARM

Figure 5 Clutch Start Switch

CLUTCH START SWITCH (FIGURE 5 AND 6)

Adjustment

1. Apply parking brake firmly and place gear shift lever in neutral position.

2. Disconnect lead wire at switch.
3. Loosen the lock nut and screw the switch out.
4. Depress clutch pedal all the way to the floor, and then return it back 15 to 30 mm (0.6-1.2in.) along its travel from the floor.
5. Connect ohmmeter to the switch, and slowly screw the switch in until it is "ON". Hold the switch at this position, and tighten the lock nut to 13 N'm (10 Ft. Lbs.)
6. Connect the lead wire.

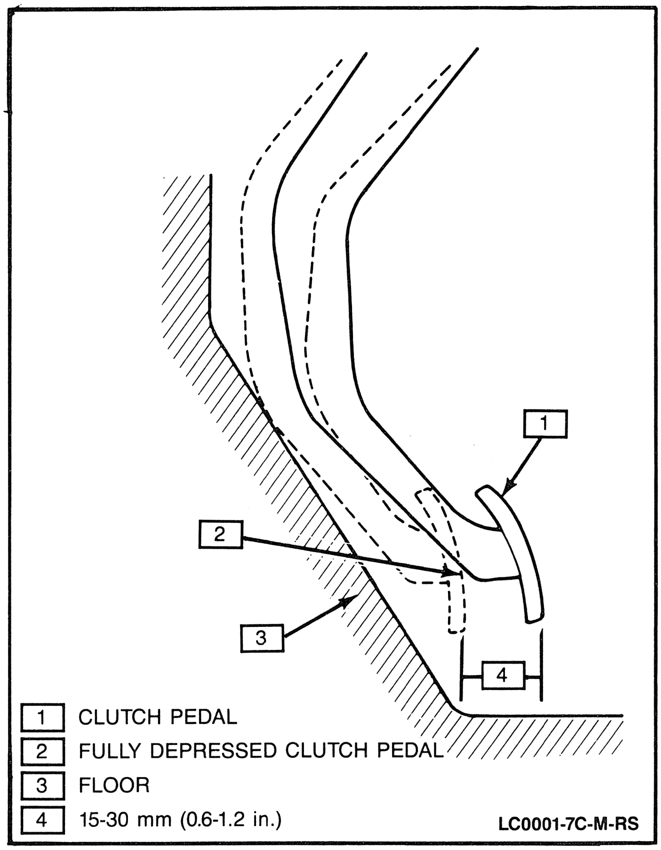


Figure 6 Clutch Pedal Position

CLUTCH CABLE (FIGURE 7)

Removal

1. Disconnect negative cable at the battery.
2. Remove clutch cable joint nut. Disconnect cable from the release arm.
3. Remove the clutch cable bracket retaining bolts and remove the bracket from the cable.
4. Remove cable retaining bolts at cowl and disconnect at pedal.
5. Remove the clutch cable from the vehicle.

Inspection

Inspect the clutch cable. Replace the clutch cable for any of the following conditions:

- Frayed Cable
- Kinked Cable
- Worn End

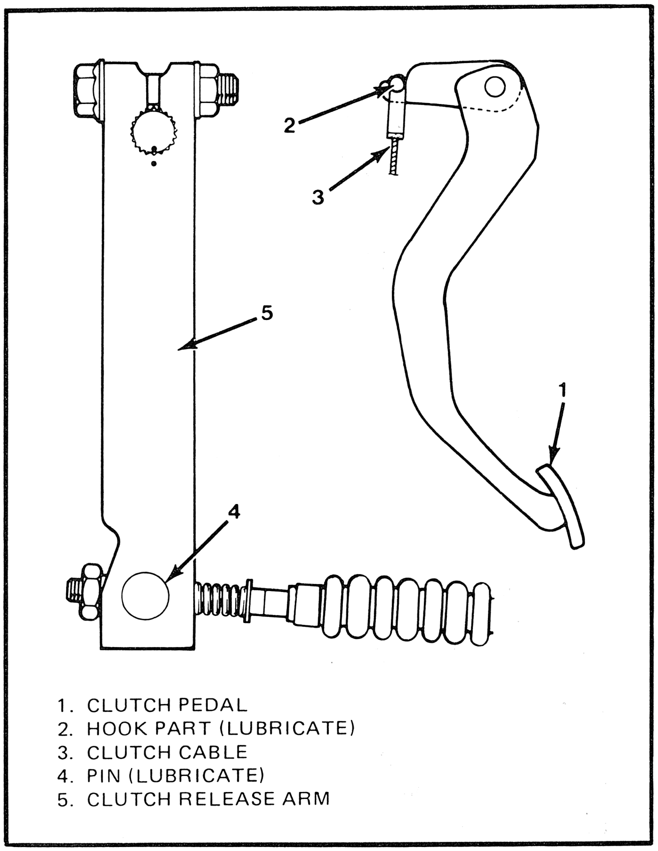


Figure 7 Hook and Pin

- Excessive Cable Friction
- Broken Boots on Cable

Installation

Apply grease to the hook and pin of the clutch cable before installing.

1. Connect cable to the clutch pedal and install the retaining bolts at cowls.
2. Install the clutch cable bracket on cable.
3. Position the bracket to the transaxle and install the retaining bolts.
4. Connect the clutch cable to the release lever and install the joint nut on the cable.
5. Adjust the clutch cable as previously outlined under Clutch Pedal Free Travel.
6. Connect the negative cable at the battery.

PRESSURE PLATE, DISC AND FLYWHEEL (FIGURE 8)

Removal

1. Remove the tranaxle as outlined under Manual Transaxle (Section 7B).
2. Install Tool J37761 into the pilot bearing to support the clutch assembly during removal. Hold flywheel stationary using J35271.
3. Loosen the clutch cover to flywheel attaching bolts evenly one turn at a time until spring pressure is released, then remove the bolts. Remove the clutch cover, clutch disc and Tool J37761 from the flywheel.

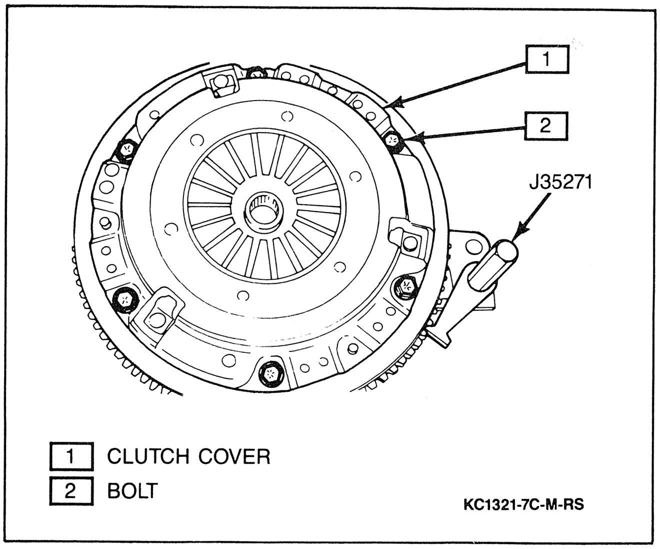

1
2
J35271
1 CLUTCH COVER
2 BOLT
KC1321-7C-M-RS

Figure 8 Flywheel Retaining Tool

Inspection

Clean the flywheel mating surfaces of all oil, grease, metal deposits, etc. Inspect the flywheel for cracks, heat checking or other defects. Replace or repair as required.

Check the wear on the facings of the clutch disc by measuring the depth of each rivet head depression. If the depth is found to have reached the service limit at any of the holes, replace the clutch disc assembly.

Check the diaphragm spring and pressure plate for wear or damage. If the spring or plate is excessively worn, or damaged, replace the clutch cover assembly. Do not disassemble the clutch cover assembly. If defective, replace the assembly.

Check the pilot bearing for smooth operation. If the bearing does not spin freely, replace it.

Installation

1. Position the clutch disc and clutch cover in relative installed position and support them with alignment tool J35271 or a drive gear. The clutch disc is installed with the damper springs to the transmission.
2. Install the clutch cover bolts and tighten down evenly and gradually until tight to avoid possible clutch distortion. Torque bolts to specifications.
3. Remove Tool J35271.
4. Lightly lubricate the splines and pilot bearing surface of the input shaft with grease #1051344 or equivalent (Figure 11).
5. Lightly lubricate the release bearing with grease #1051344 or equivalent (Figure 12).

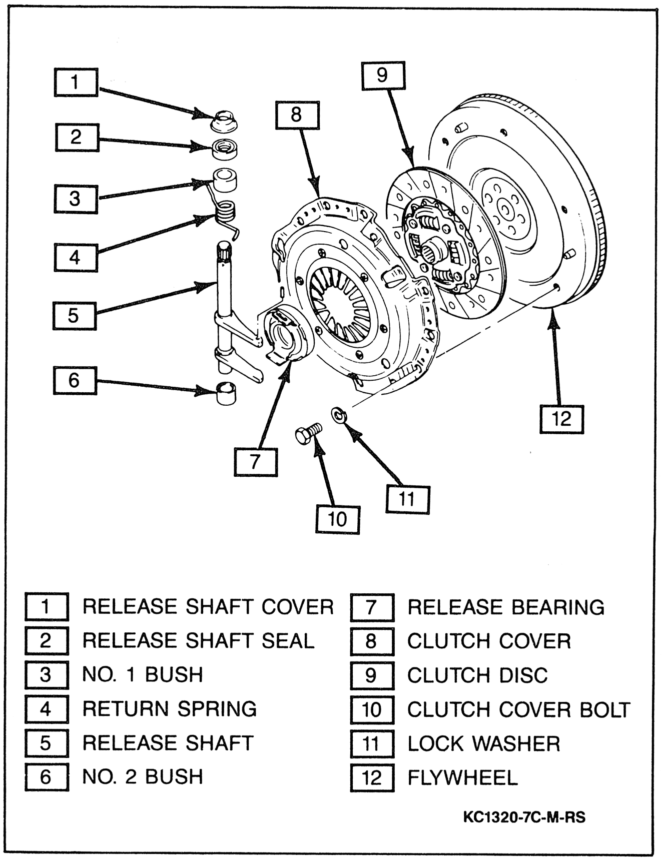
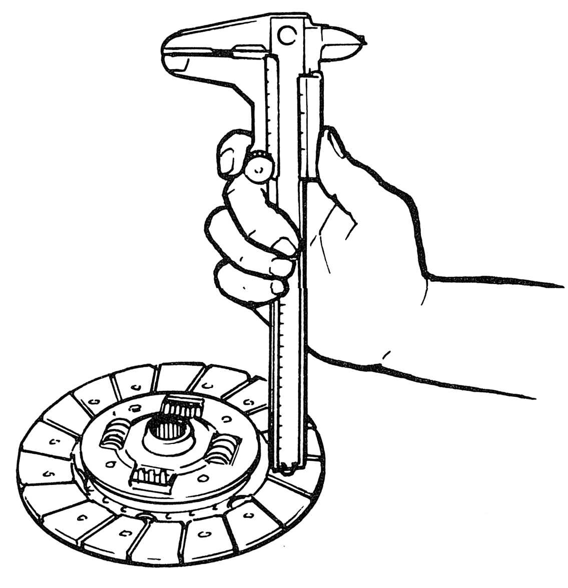

1
2
3
4
5
6
7
8
9
10
11
12
1 RELEASE SHAFT COVER
2 RELEASE SHAFT SEAL
3 NO. 1 BUSH
4 RETURN SPRING
5 RELEASE SHAFT
6 NO. 2 BUSH
7 RELEASE BEARING
8 CLUTCH COVER
9 CLUTCH DISC
10 CLUTCH COVER BOLT
11 LOCK WASHER
12 FLYWHEEL
KC1320-7C-M-RS

Figure 9 Clutch Exploded View



	Standard	Service Limit
Rivet Head Depth	1.2 mm (0.05 in.)	0.5 mm (0.02 in.)

Figure 10 Measuring Depth of Rivet Head

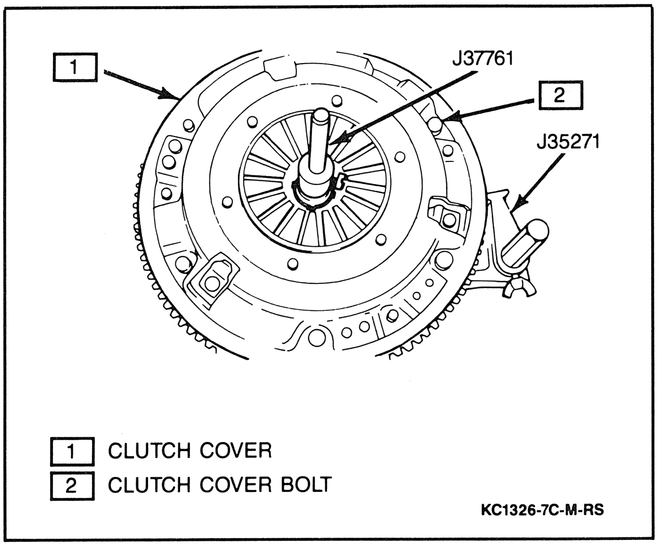

1
J37761
2
J35271
1 CLUTCH COVER
2 CLUTCH COVER BOLT
KC1326-7C-M-RS

Figure 11 Installing Clutch Disc and Cover

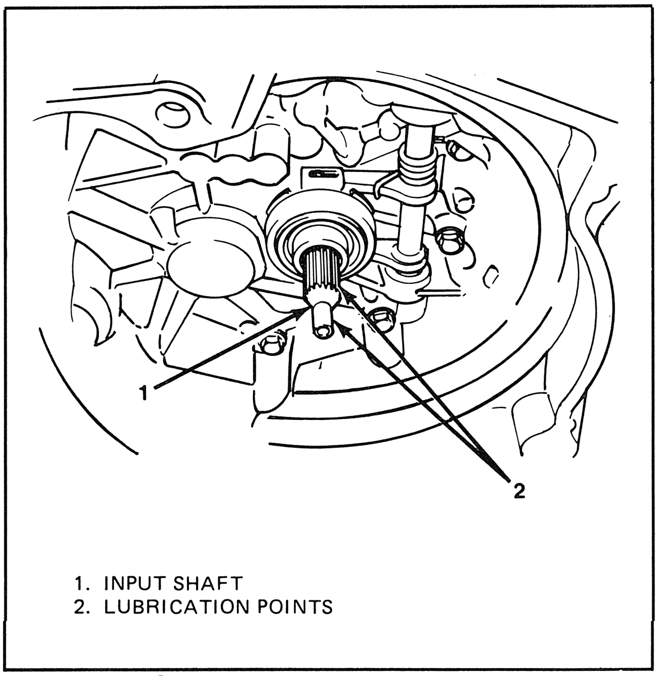

1
2
1. INPUT SHAFT
2. LUBRICATION POINTS

Figure 12 Lubricating Input Shaft

6. Install the transaxle as outlined in Manual Transaxle (Section 7B).
7. Adjust the clutch cable as previously outlined under Clutch Pedal Free Travel.

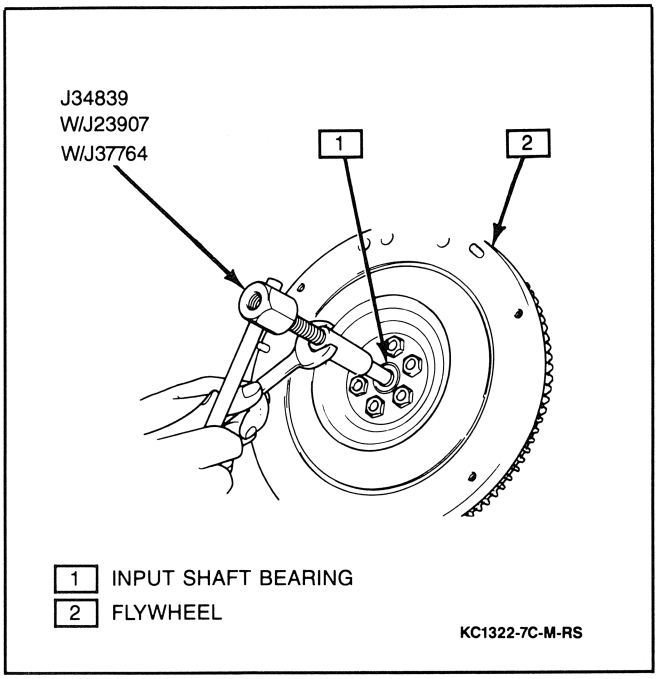

J34839
W/J23907
W/J37764
1
2
1 INPUT SHAFT BEARING
2 FLYWHEEL
KC1322-7C-M-RS

Figure 13 Pilot Bearing Removal

PILOT BEARING (FIGURE 13 AND 14)

Replacement

1. Remove the transaxle as outlined in Manual Transaxle (Section 7B).
2. Remove the clutch cover and disc as previously outlined in this section.
3. Remove the pilot bearing using Tool J-34839.
4. Install the pilot bearing using Tool J-34848 and J36190.
5. Install the clutch cover and disc as previously outlined in this section.
6. Install the transaxle as outlined in the Manual Transaxle (Section 7B).

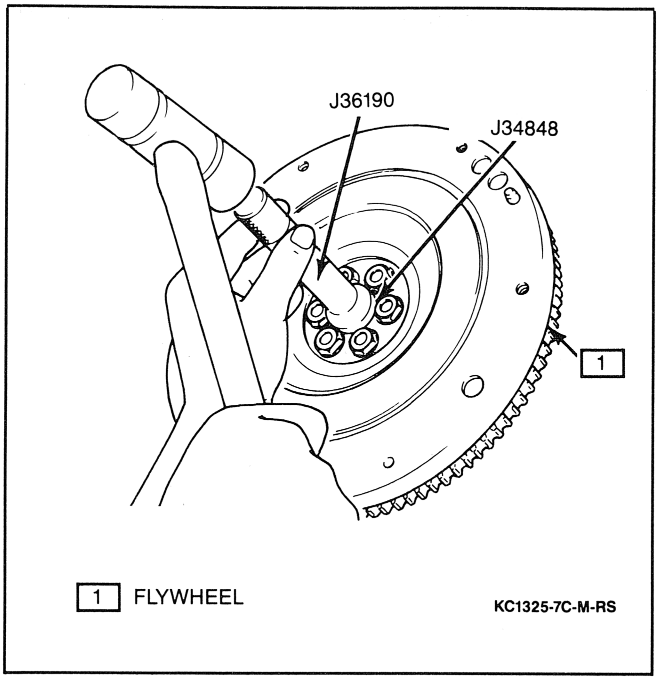

J36190
J34848
1
1 FLYWHEEL
KC1325-7C-M-RS

Figure 14 Pilot Bearing Installation

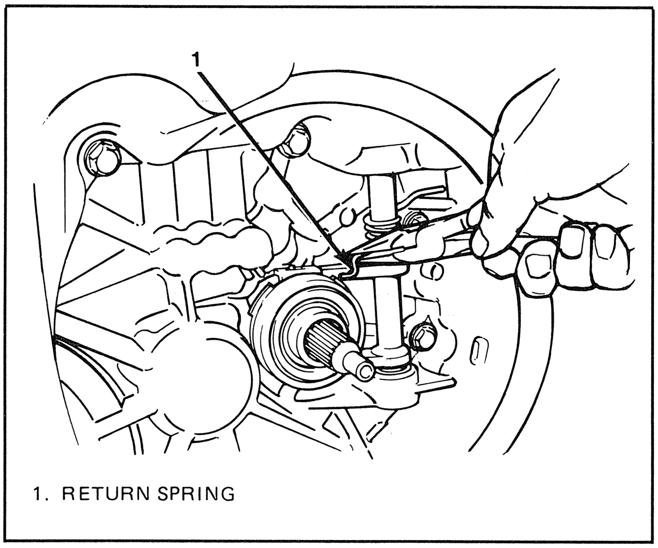

1
1. RETURN SPRING

Figure 15 Unhooking Return Spring

CLUTCH RELEASE BEARING (FIGURE 16)

Replacement

1. Remove the transaxle as outlined in the Manual Transaxle (Section 7B).
2. Disconnect the return spring from the shaft fork.
3. Remove the clutch release bearing from the transaxle.

   Inspect the release bearing for rough rotation, wear or damage. If any of the above conditions are found, replace the bearing.

NOTICE: Do not place bearing in degreaser or damage to the seals may result.

4. Lightly lubricate the release bearing with grease #1051344 or equivalent (Figure 16).
5. Install the clutch release bearing.

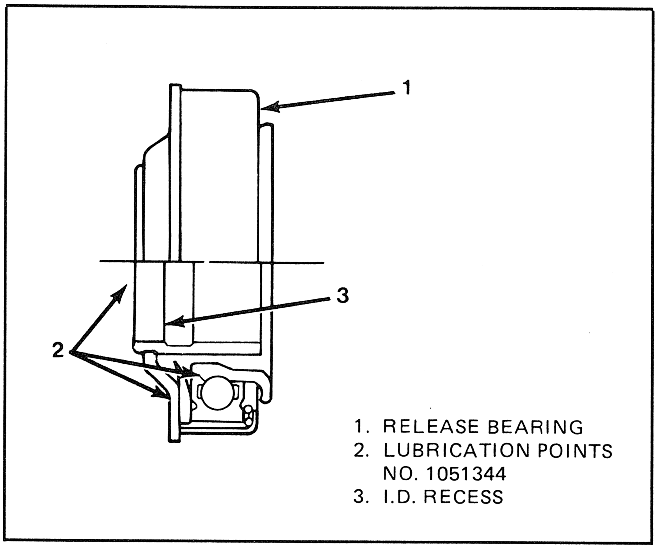

1
2
3
1. RELEASE BEARING
2. LUBRICATION POINTS NO. 1051344
3. I.D. RECESS

Figure 16 Lubricating Clutch Release Bearing

6. Connect the return spring to the shaft fork.
7. Install the transaxle as outlined in the Manual Transaxle (Section 7B).

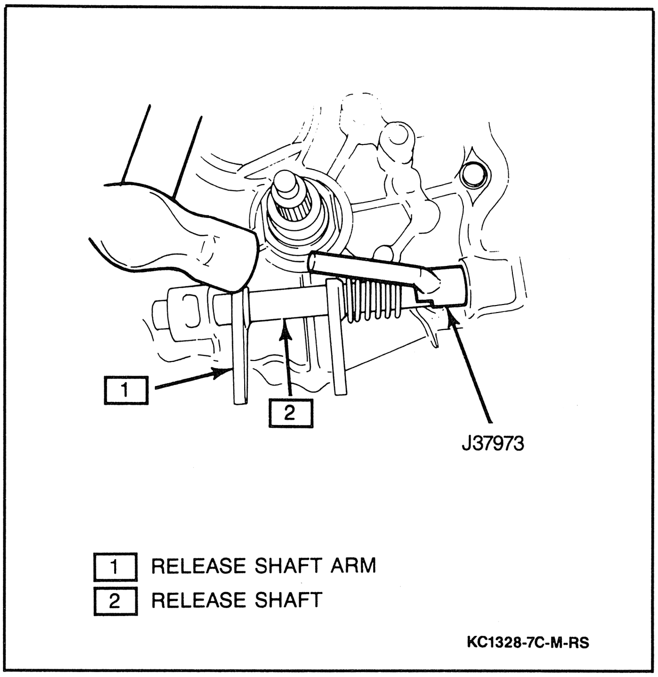
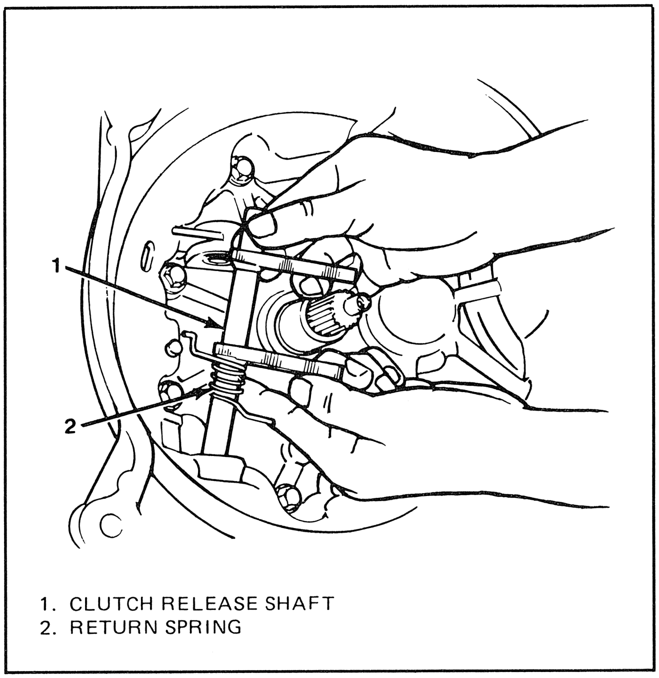

1
2
J37973
1 RELEASE SHAFT ARM
2 RELEASE SHAFT
KC1328-7C-M-RS

Figure 17 Removing No. 1 Bushing and Shaft Seal

CLUTCH RELEASE SHAFT AND SHAFT BUSHINGS

Replacement (Figures 17 - 24)

1. Remove the transaxle as outlined in the Manual Transaxle (Section 7B).
2. Disconnect the return spring from the shaft fork.
3. Remove the clutch release bearing.
4. Remove the clutch release arm.
5. Remove the release shaft seal and #2 bushing using Tool J-37973 (Figure 17).
6. Remove the release shaft and return spring from the transaxle.



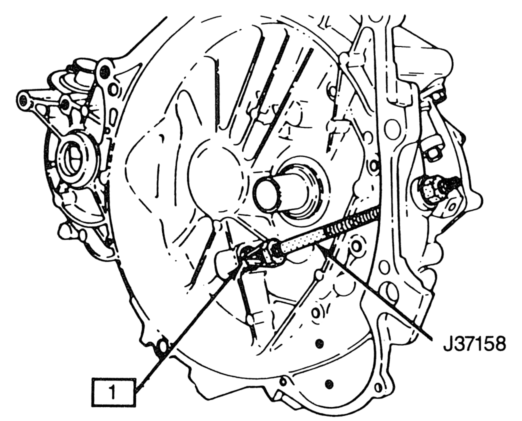
1. CLUTCH RELEASE SHAFT
2. RETURN SPRING

Figure 18 Release Shaft and Return Spring Removal

7. Remove the #1 bushing from the transaxle using Tool J37158 (Figure 19).

   Inspect the transaxle retainer for wear (Figure 20). If the retainer is excessively worn or damaged, replace the right case.

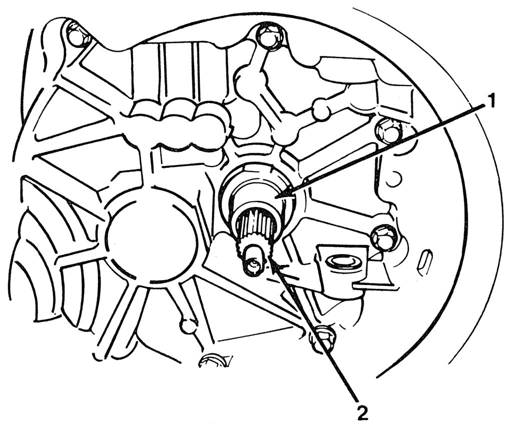
8. Install the #1 bushing into the transaxle (Figure 21). After installing, apply grease to the I.D. of the bushing.
9. Install the release shaft and return spring.
10. Install the #2 bushing into the transaxle using Tool J37973 (Figure 22). Before installing, apply grease to the I.D. of the bushing.
11. Install the shaft seal. Before installing, apply grease to the lip portion of the seal. After installation of the seal, stake the transaxle case against the seal at two points (Figure 23).
12. Slide the shaft seal cover onto the release shaft.
13. Install the clutch release arm. Align punch mark on release arm with punch mark on release shaft (Figure 24).
14. Install the clutch release bearing. Before installing, lubricate the bearing with grease (Figure 16).
15. Hook the return spring end to the release shaft fork.
16. Install the transaxle as outlined in the Manual Transaxle (Section 7B).
17. Adjust the clutch as previously outlined in this section.



1 NO. 1 BUSHING

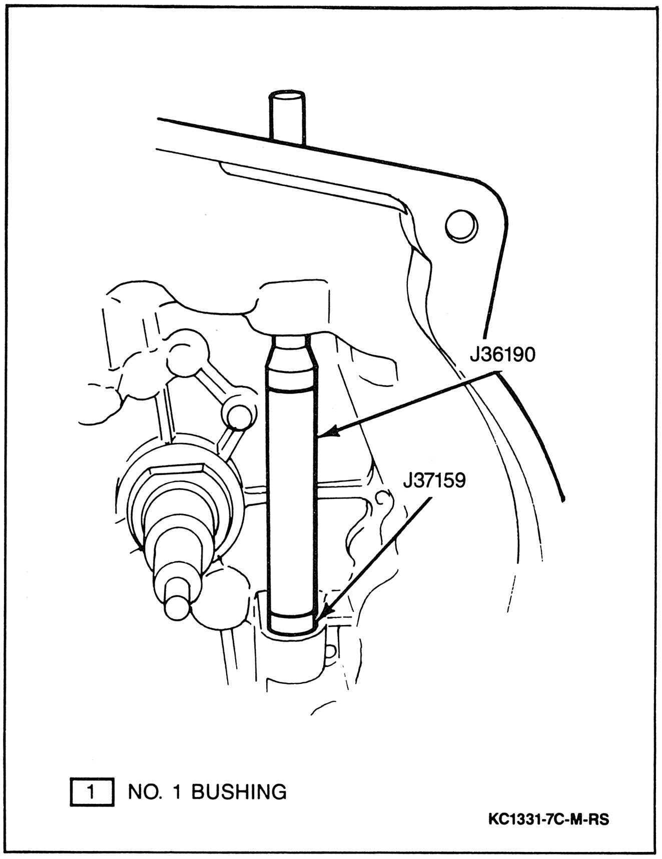
KC1336-7C-M-RS

Figure 19 Removing #1 Bushing



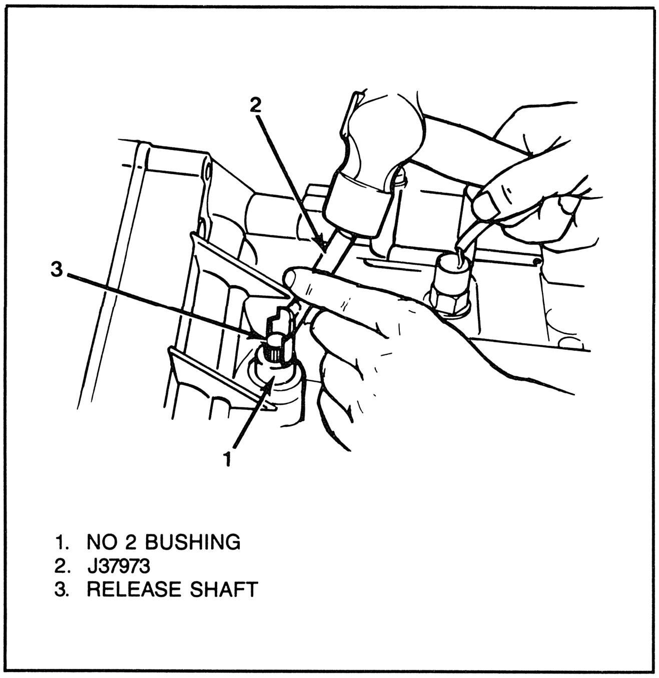
1. TRANSAXLE RETAINER
2. INPUT SHAFT

Figure 20 Transaxle Retainer



1 NO. 1 BUSHING

Figure 21 Installing #1 Bushing



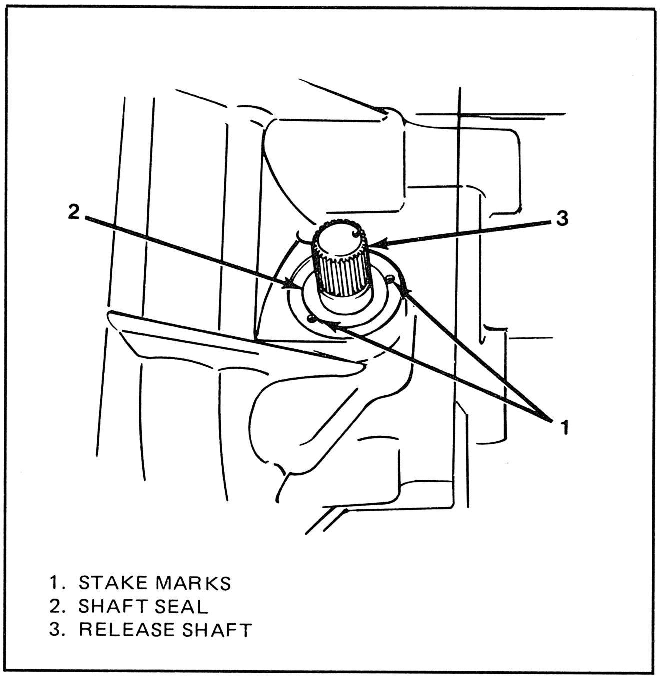
1. NO 2 BUSHING
2. J37973
3. RELEASE SHAFT

Figure 22 Installing #2 Bushing

CLUTCH PEDAL

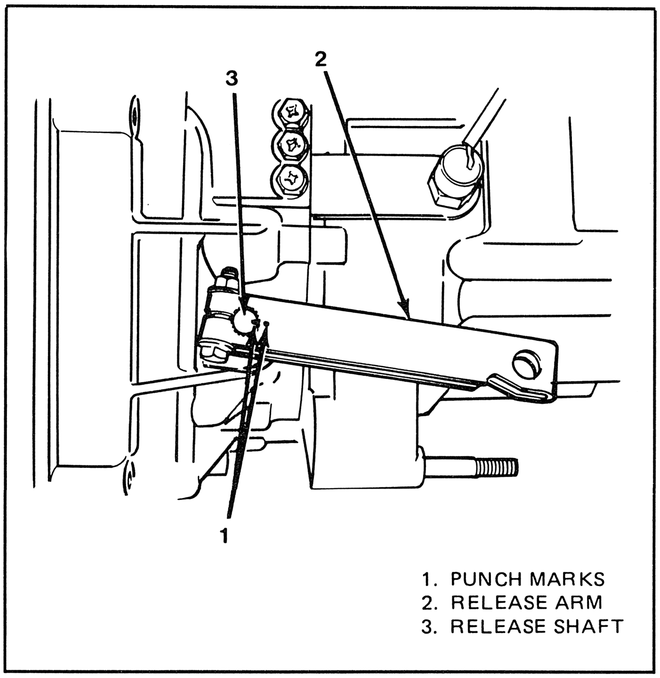
Remove or Disconnect

1. Loosen arm bolt.
2. Clutch pedal shaft arm.
3. Clutch pedal spring while sliding clutch pedal out.



1. STAKE MARKS
2. SHAFT SEAL
3. RELEASE SHAFT

Figure 23 Staking Seal



1. PUNCH MARKS
2. RELEASE ARM
3. RELEASE SHAFT

Figure 24 Release Arm Alignment

NOTICE: Pedal pad can be removed without removing clutch pedal assembly by pulling rubber lip up around clutch pedal outer edges.

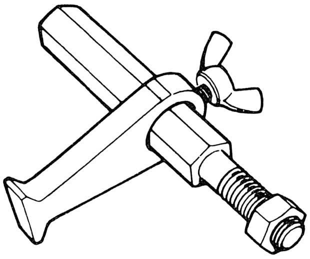
Install or Connect

1. Clutch pedal spring while sliding clutch pedal into position through shaft bushing and pedal bracket.
2. Clutch pedal shaft arm.

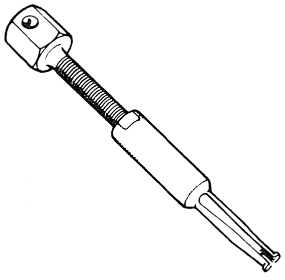
Tighten

- Arm bolt

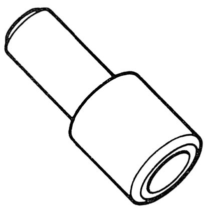
NOTICE: Pedal pad can be replaced by pulling rubber lip around pedal outer edges.



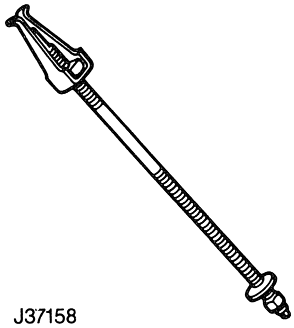
J35271
Flywheel Holder



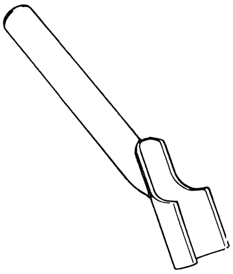
J34839
Bearing Remover



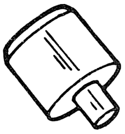
J37159
Clutch Shaft Inner
Bearing Installer



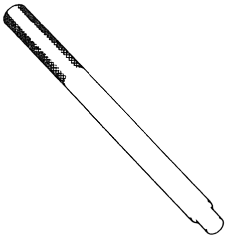
J37158
Clutch Shaft Inner
Bearing Remover



J37973
Bushing Remover



J34848
Clutch Pilot
Bearing Installer



J36190
Driver Handle

SPECIAL TOOLS

J37761	Clutch Pilot
J34839	Pilot Bearing Remover
J34848	Pilot Bearing Installer
J35158	Clutch Release Shaft #1 Bushing Remover
J36190, 37159	Clutch Release Shaft #1 Installer
J37973	Clutch Release Shaft #2 Bushing Remover/Installer
J35271	Flywheel Holder

TORQUE SPECIFICATIONS

Fastening Portion	Tightening Torque	
	N·m	lb.-ft.
1. Switch lock nut	13	10.0
2. Clutch cable outer bolts	6	4.4
3. Flywheel bolts	61	45.0
4. Clutch cover bolts	23	17.0
5. Release arm bolt	13	10.0
6. Cable bracket bolts	23	17.0

REQUIRED SERVICE MATERIALS

MATERIAL	RECOMMENDED SUZUKI PRODUCT	USE
Lithium grease	GM Wheel Bearing Lubricant #1051344	• Cable end hook and joint pin. • Release shaft bushing and seal. • Release bearing inside and release shaft arm. • Input shaft spline and front end.
Water tight sealant	GM Silicone Sealer (RTV) #1052751	• Clutch cable fastening portion with dash panel.

SPECIFICATIONS

Application		Millimeters	Inches
Clutch Pedal Height Difference	A:	8	0.3
Clutch Pedal Free Travel	A:	15-20	0.6-0.8
Clutch Start Switch Adjustment	A:	15-30	0.6-1.2
	C:	0.5-1.0	0.02-0.04
Rivet Head Depth	Standard:	1.2	0.05
	Service Limit:	0.5	0.02

SECTION 8

BODY AND CHASSIS ELECTRICAL

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GENERAL DESCRIPTION

The chassis electrical components of this vehicle are designed to operate on 12 volts power supplied by the battery. The electrical system utilizes negative ground polarity.

WIRING

All chassis low voltage wires are insulated. The insulation is color coded for identification of individual chassis circuits.

BODY ELECTRICAL SYSTEM

FUSES

The main fuseblock is located on the left hand fender apron in the engine compartment. The junction/fuseblock is located under the instrument panel on the left hand side. The designation of each main fuse is shown in Figure 1. The designation and location of each junction/fuseblock fuse is shown in Figure 2.

CAUTION:

- When replacing a fuse, be sure to use one having the correct amperage rating.
- Before replacing a fuse, turn OFF all switches, including the ignition switch.

SWITCHES

Steering Column (Ignition) Switch

Remove or Disconnect (Figure 2)

1. Negative battery cable.
2. Ignition switch connectors (4 wire and 5 wire) from the junction/fuseblock (Figure 2).

Install or Connect (Figure 2)

1. Ignition switch connectors (4 wire and 5 wire) to the junction/fuseblock (Figure 2).
2. Negative battery cable.

Checking Continuity Between Terminals (Ignition Switch)

Use a circuit tester to check continuity at each switch position (Figures 3 and 4). If there is a lack of continuity at any switch position, replace switch. If necessary refer to STEERING WHEEL AND COLUMN (Section 3F).

Turn Signal/Dimmer Switch

This switch incorporates the turn signal, dimmer, and passing light switches.

Remove or Disconnect (Figure 2)

1. Battery ground cable.
2. Turn signal/dimmer switch lead wire connectors from junction/fuseblock (Figure 2).

Inspect (Figures 5 and 6)

- Use a circuit tester to check for continuity at each switch position (Figures 5 and 6).

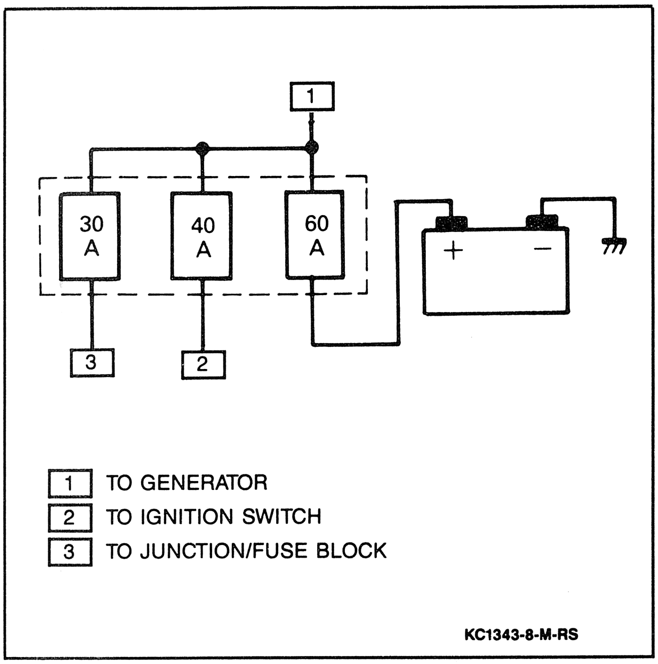


Figure 1 Main Fuseblock Circuit

Install or Connect (Figure 2)

1. Turn signal/dimmer switch lead wire connectors to junction/fuseblock (Figure 2).
2. Battery ground cable.

Light/Hazard Flasher Switch

Inspect (Figure 7)

1. Light switch and connector.

Front Windshield Wiper/Washer Switch

Inspect (Figure 8)

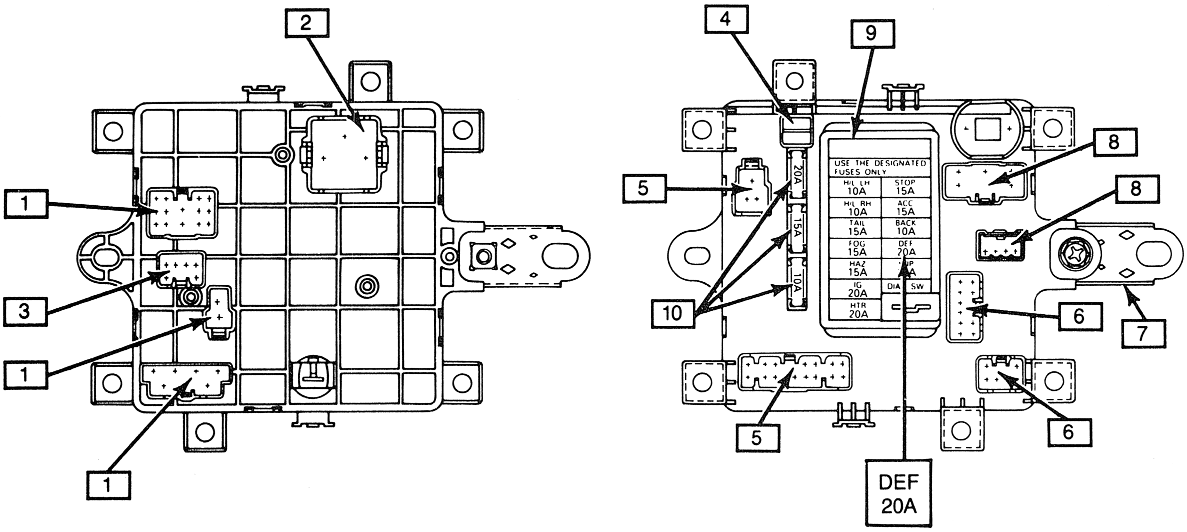
1. Wiper/washer switch and connector.

Panel Lights Rheostat

Inspect (Figure 9)

1. Connect a test lamp to wire (Figure 9).

NOTICE: If rheostat fails to dim or brighten test lamp or switch operation is not smooth, the rheostat must be replaced.


2
1
3
1
1
4
9
5
10
8
8
6
7
5
6
DEF 20A
20A
15A
10A
USE THE DESIGNATED FUSES ONLY
H/L LH 10A
STOP 15A
H/L RH 10A
ACC 15A
TAIL 15A
BACK 10A
FOG 15A
DEF 20A
HAZ 15A
IG 20A
DIA SW
HTR 20A

1	TO MAIN WIRING HARNESS NO. 1
2	TURN SIGNAL RELAY
3	TO FLOOR WIRING HARNESS NO. 3
4	FUSE PULLER
5	TO INSTRUMENT PANEL WIRING HARNESS NO. 2
6	TO TURN SIGNAL/DIMMER SWITCH
7	GROUND
8	TO IGNITION SWITCH
9	FUSE BLOCK
10	SPARE FUSES

KC1342-8-M-RS

Figure 2 Junction/Fuseblock Designation And Location

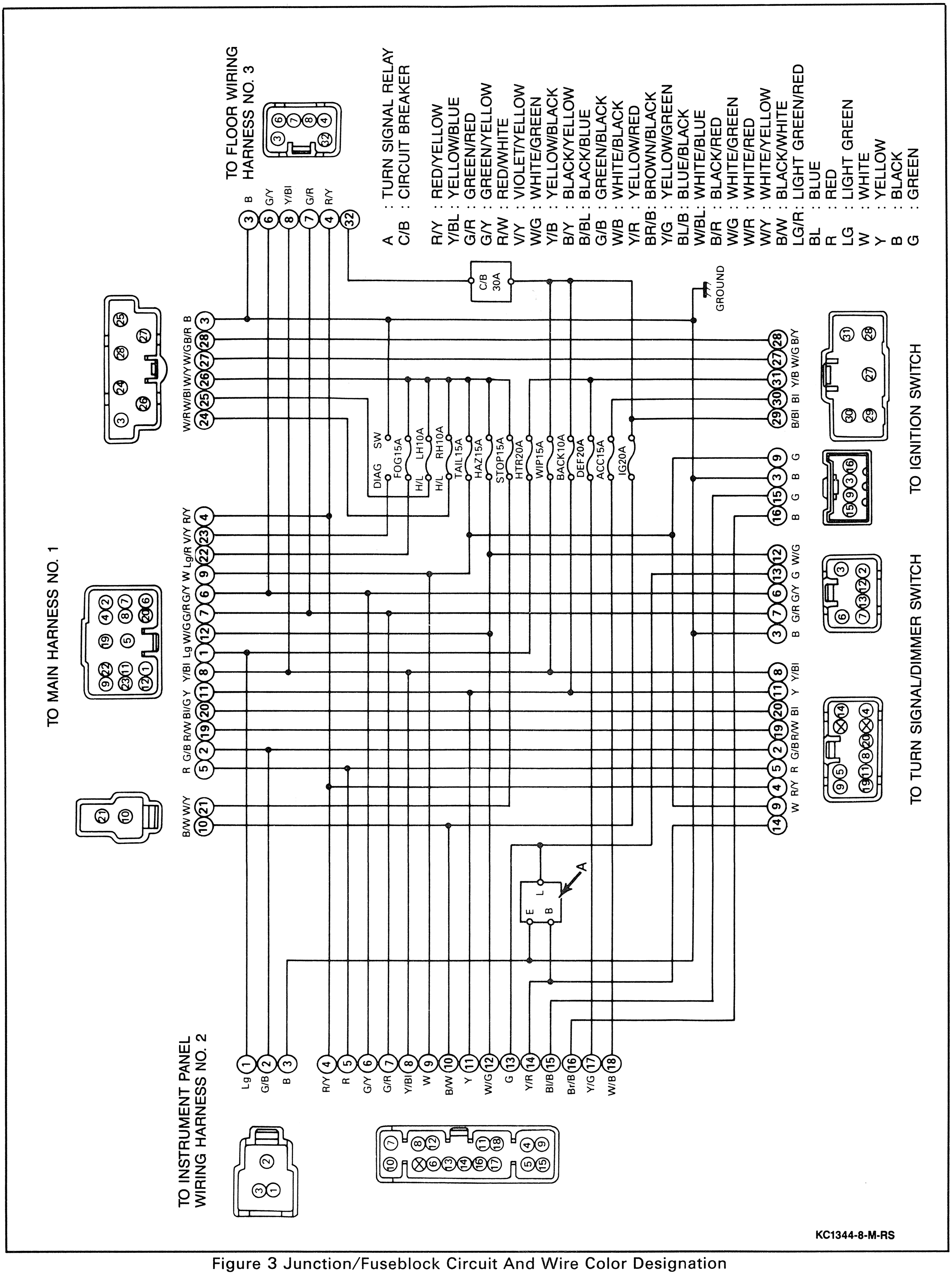

TO FLOOR WIRING HARNESS NO. 3
TO MAIN HARNESS NO. 1
TO INSTRUMENT PANEL WIRING HARNESS NO. 2
TO IGNITION SWITCH
TO TURN SIGNAL/DIMMER SWITCH
GROUND
C/B 30A
A
E
L
B
DIAG
SW
FOG15A
H/L
LH10A
RH10A
TAIL15A
HAZ15A
STOP15A
HTR20A
WIP15A
BACK10A
DEF20A
ACC15A
IG20A
A : TURN SIGNAL RELAY
C/B : CIRCUIT BREAKER
R/Y : RED/YELLOW
Y/BL : YELLOW/BLUE
G/R : GREEN/RED
G/Y : GREEN/YELLOW
R/W : RED/WHITE
V/Y : VIOLET/YELLOW
W/G : WHITE/GREEN
Y/B : YELLOW/BLACK
B/Y : BLACK/YELLOW
B/BL : BLACK/BLUE
G/B : GREEN/BLACK
W/B : WHITE/BLACK
Y/R : YELLOW/RED
BR/B : BROWN/BLACK
Y/G : YELLOW/GREEN
BL/B : BLUE/BLACK
W/BL : WHITE/BLUE
B/R : BLACK/RED
W/G : WHITE/GREEN
W/R : WHITE/RED
W/Y : WHITE/YELLOW
B/W : BLACK/WHITE
LG/R : LIGHT GREEN/RED
BL : BLUE
R : RED
LG : LIGHT GREEN
W : WHITE
Y : YELLOW
B : BLACK
G : GREEN
KC1344-8-M-RS

Figure 3 Junction/Fuseblock Circuit And Wire Color Designation

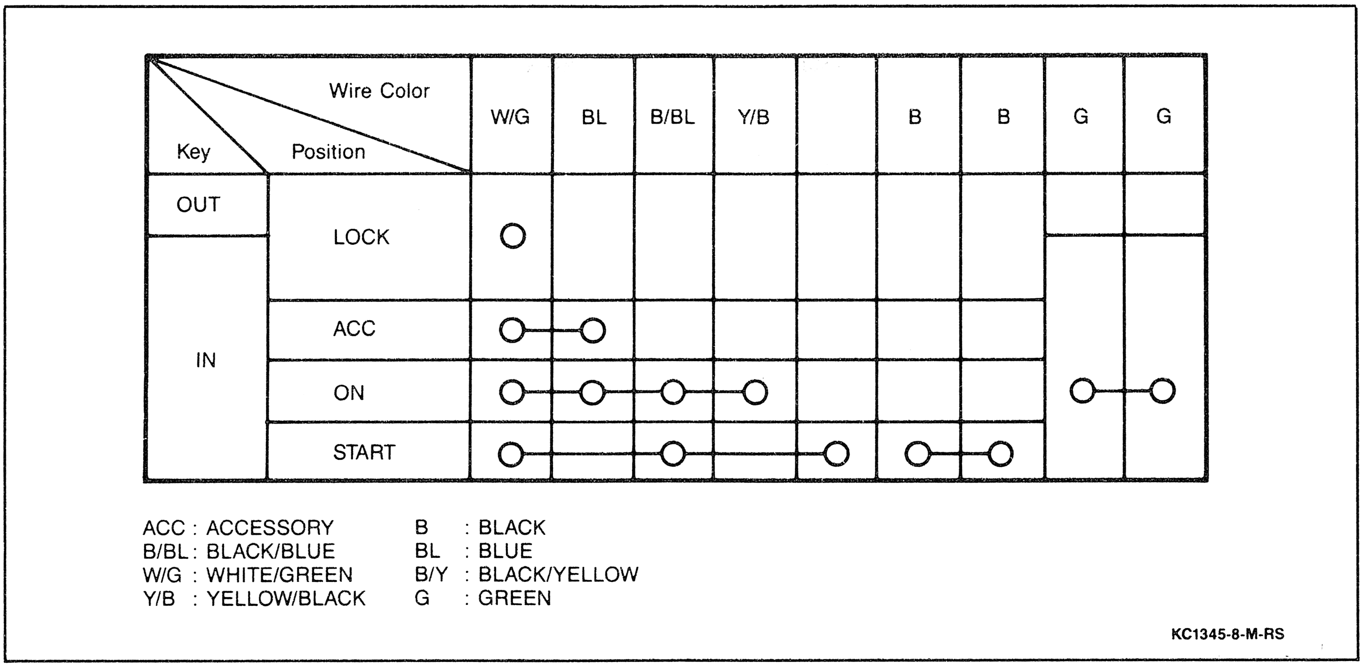

Wire Color
Key
Position
W/G
BL
B/BL
Y/B
B
B
G
G
OUT
IN
LOCK
ACC
ON
START
ACC : ACCESSORY
B/BL : BLACK/BLUE
W/G : WHITE/GREEN
Y/B : YELLOW/BLACK
B : BLACK
BL : BLUE
B/Y : BLACK/YELLOW
G : GREEN
KC1345-8-M-RS

Figure 4 Continuity Check

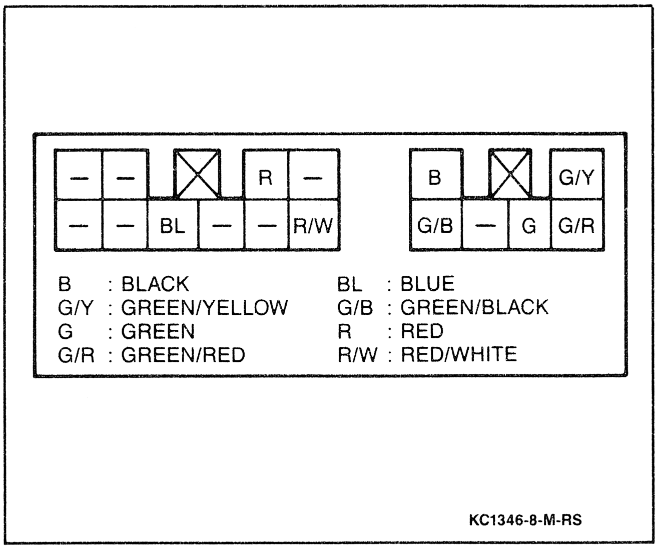

—
—
R
—
—
—
BL
—
—
R/W
B
G/Y
G/B
—
G
G/R
B : BLACK
G/Y : GREEN/YELLOW
G : GREEN
G/R : GREEN/RED
BL : BLUE
G/B : GREEN/BLACK
R : RED
R/W : RED/WHITE
KC1346-8-M-RS

Figure 5 Column Switch Connections

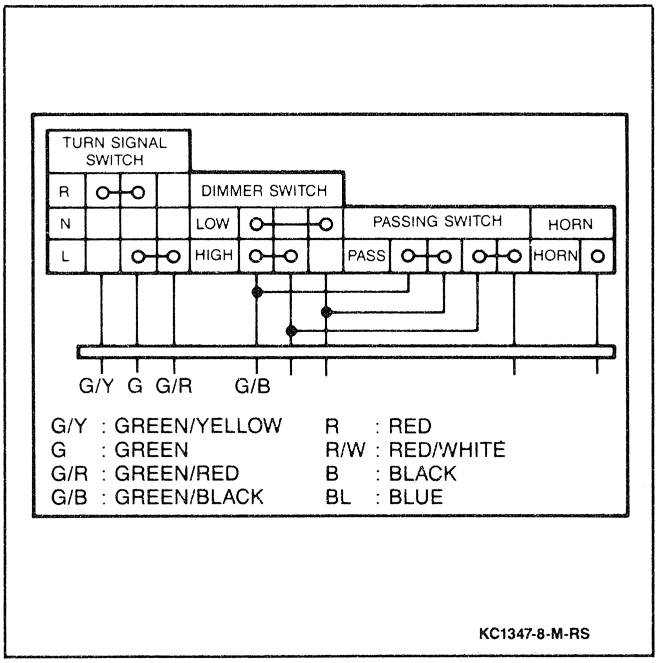

TURN SIGNAL SWITCH
R
N
L
DIMMER SWITCH
LOW
HIGH
PASSING SWITCH
PASS
HORN
HORN
G/Y
G
G/R
G/B
G/Y : GREEN/YELLOW
G : GREEN
G/R : GREEN/RED
G/B : GREEN/BLACK
R : RED
R/W : RED/WHITE
B : BLACK
BL : BLUE
KC1347-8-M-RS

Figure 6 Continuity Check

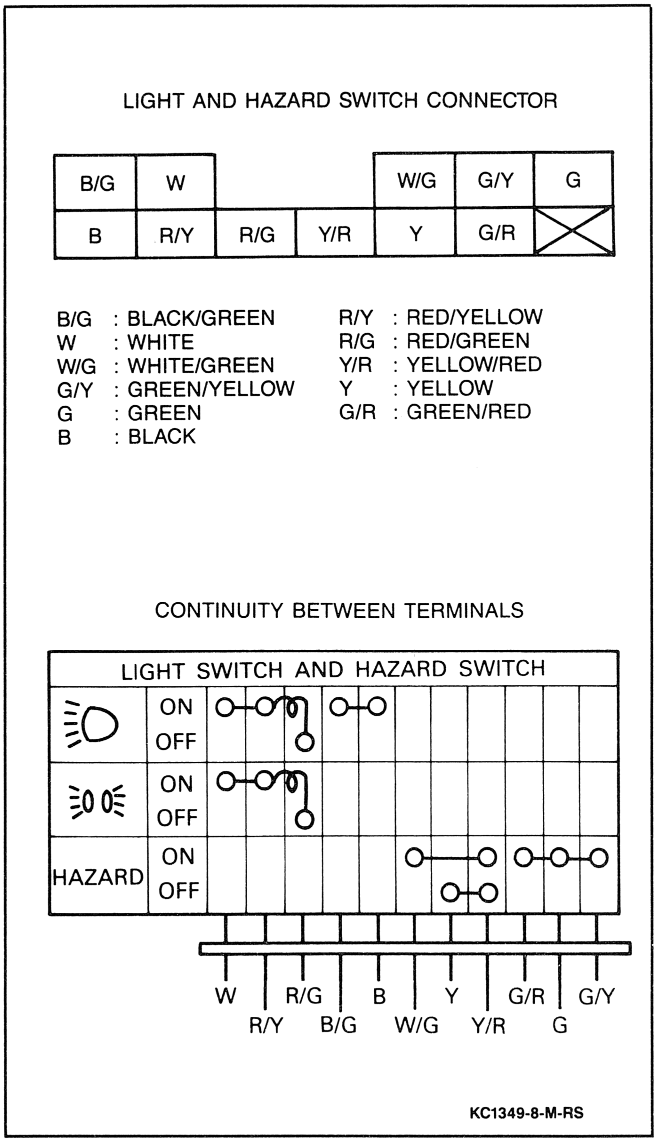

LIGHT AND HAZARD SWITCH CONNECTOR
B/G
W
W/G
G/Y
G
B
R/Y
R/G
Y/R
Y
G/R
B/G : BLACK/GREEN
W : WHITE
W/G : WHITE/GREEN
G/Y : GREEN/YELLOW
G : GREEN
B : BLACK
R/Y : RED/YELLOW
R/G : RED/GREEN
Y/R : YELLOW/RED
Y : YELLOW
G/R : GREEN/RED
CONTINUITY BETWEEN TERMINALS
LIGHT SWITCH AND HAZARD SWITCH
ON
OFF
ON
OFF
HAZARD
ON
OFF
W
R/G
B
Y
G/R
G/Y
R/Y
B/G
W/G
Y/R
G
KC1349-8-M-RS

Figure 7 Continuity Check-Light Switch and Connector

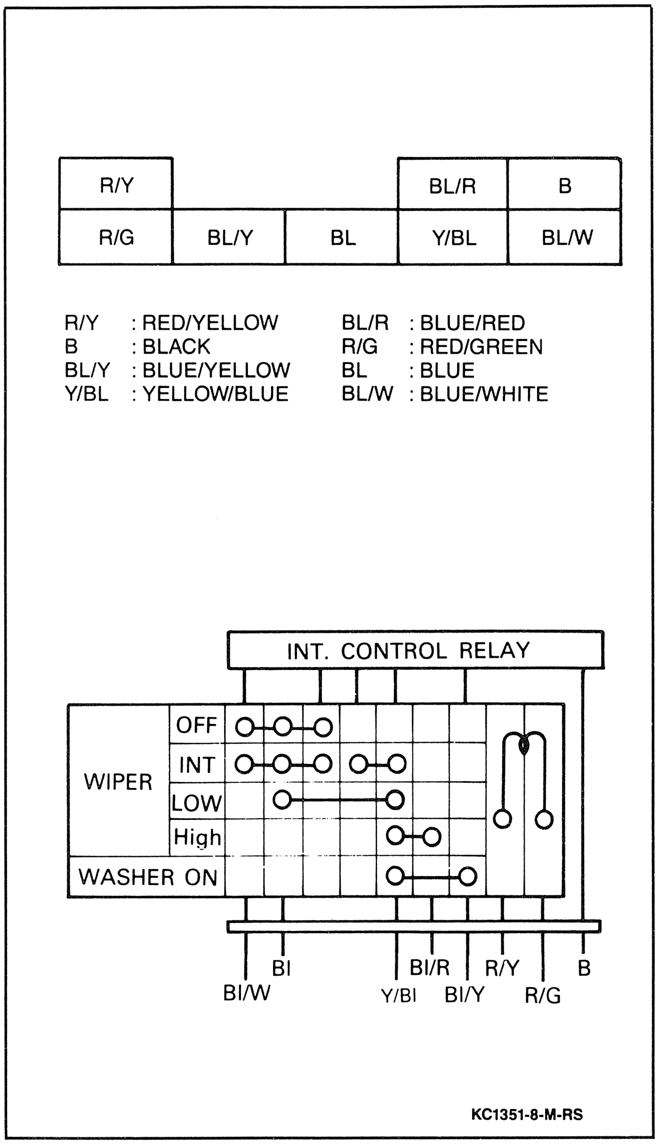
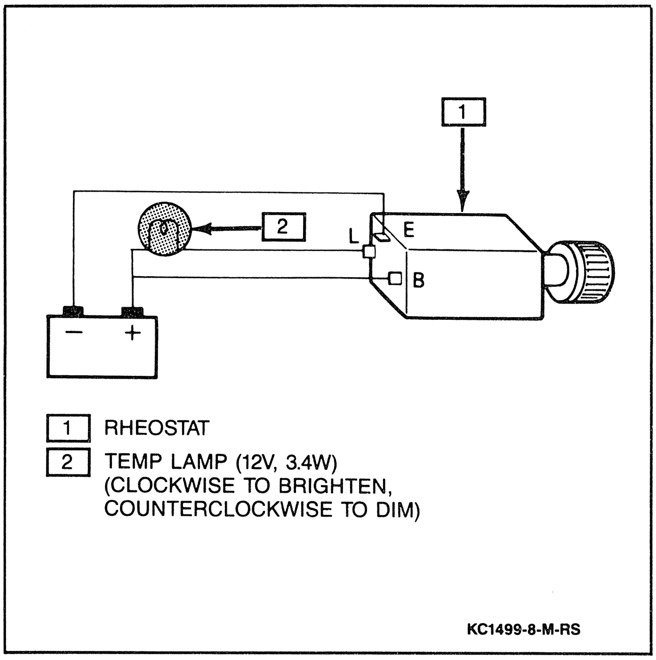

R/Y
BL/R
B
R/G
BL/Y
BL
Y/BL
BL/W
R/Y : RED/YELLOW
B : BLACK
BL/Y : BLUE/YELLOW
Y/BL : YELLOW/BLUE
BL/R : BLUE/RED
R/G : RED/GREEN
BL : BLUE
BL/W : BLUE/WHITE
INT. CONTROL RELAY
WIPER
OFF
INT
LOW
High
WASHER ON
Bl
Bl/W
Bl/R
R/Y
B
Y/Bl
Bl/Y
R/G
KC1351-8-M-RS

Figure 8 Continuity Check-Wiper/Washer Switch and Connector


1
2
L
E
B
−
+
KC1499-8-M-RS

1 RHEOSTAT

2 TEMP LAMP (12V, 3.4W) (CLOCKWISE TO BRIGHTEN, COUNTERCLOCKWISE TO DIM)

Figure 9 Checking Panel Lights

INSTRUMENT PANEL AND GAGES

FUEL GAGE

Description of Circuit

The fuel gage circuit consists of the fuel gage and the sending unit in the tank (Figure 11). Current flowing through the gage coil is varied to control the movement of the gage pointer. When the tank is full, the sending unit resistance is decreased allowing more current flow into the gage coil causing the pointer to move to the "F" (FULL) position (Figure 11).

Remove or Disconnect

1. Negative battery cable.
2. Rear seat.
3. Electrical leads from sending unit (yellow/red).

Inspect (Figures 12 and 13)

- Connect negative battery cable.
- Use a test bulb to ground the lead wire (Figure 12).
- Turn the ignition switch "ON." The bulb should light and the gage pointer should fluctuate after a few seconds. If not, remove the fuel gage to check it.
- Measure the gage coil for "F" to "E" resistance (Figure 13).
- If fuel gage does not meet specifications, replace gage.
- Disconnect negative battery cable.

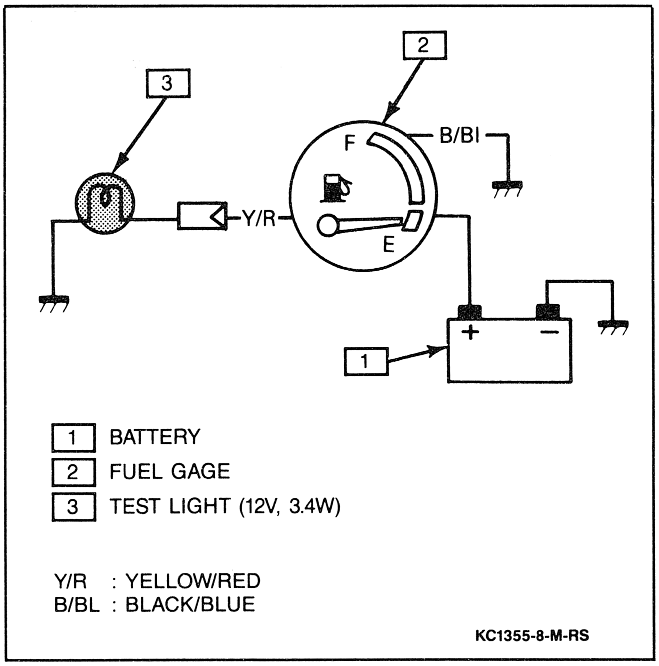

2
3
F
B/BI
Y/R
E
1
+
−
1 BATTERY
2 FUEL GAGE
3 TEST LIGHT (12V, 3.4W)
Y/R : YELLOW/RED
B/BL : BLACK/BLUE
KC1355-8-M-RS

Figure 12 Testing Fuel Gage

Install or Connect

1. Electrical leads to sending unit (yellow/red).
2. Rear seat.
3. Negative battery cable.

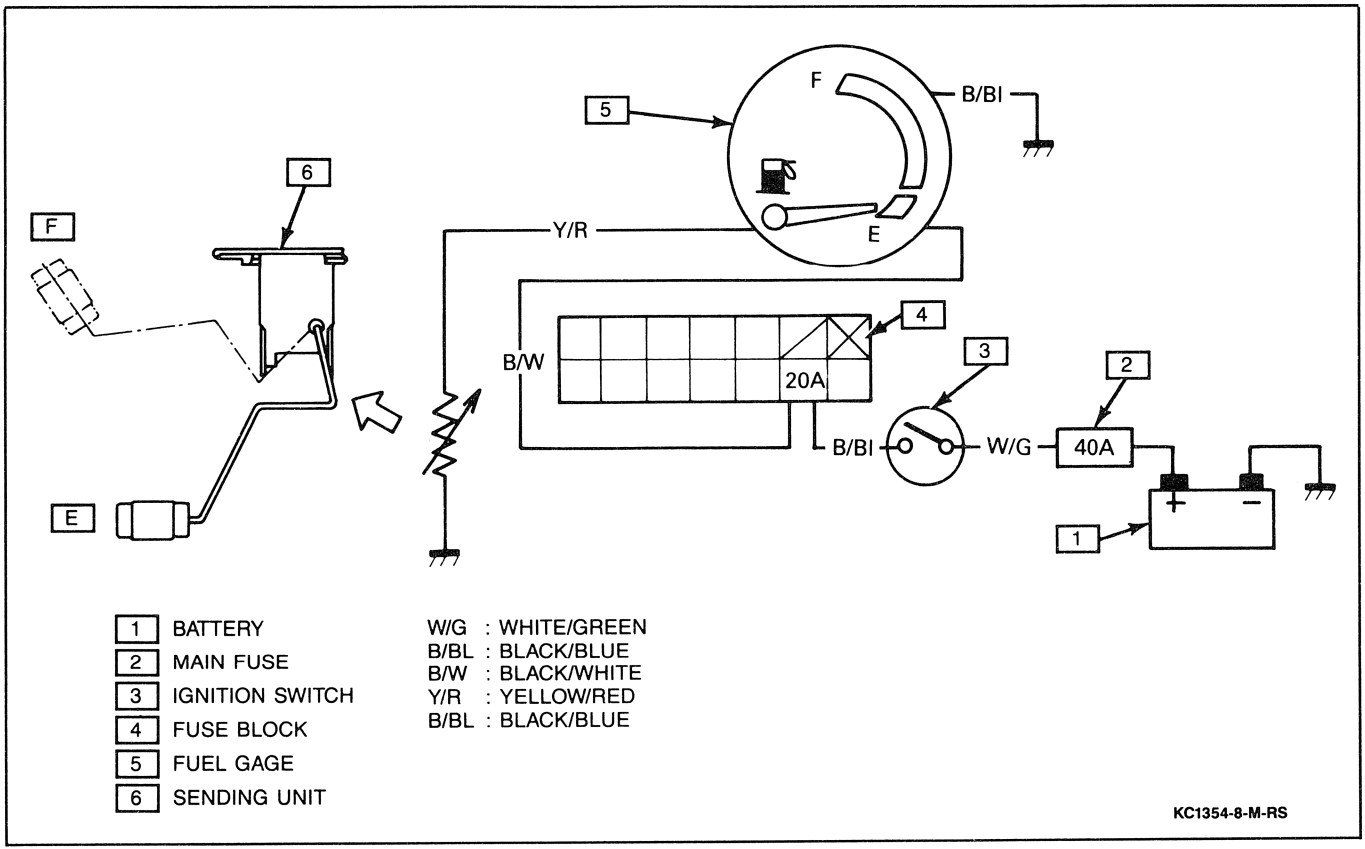
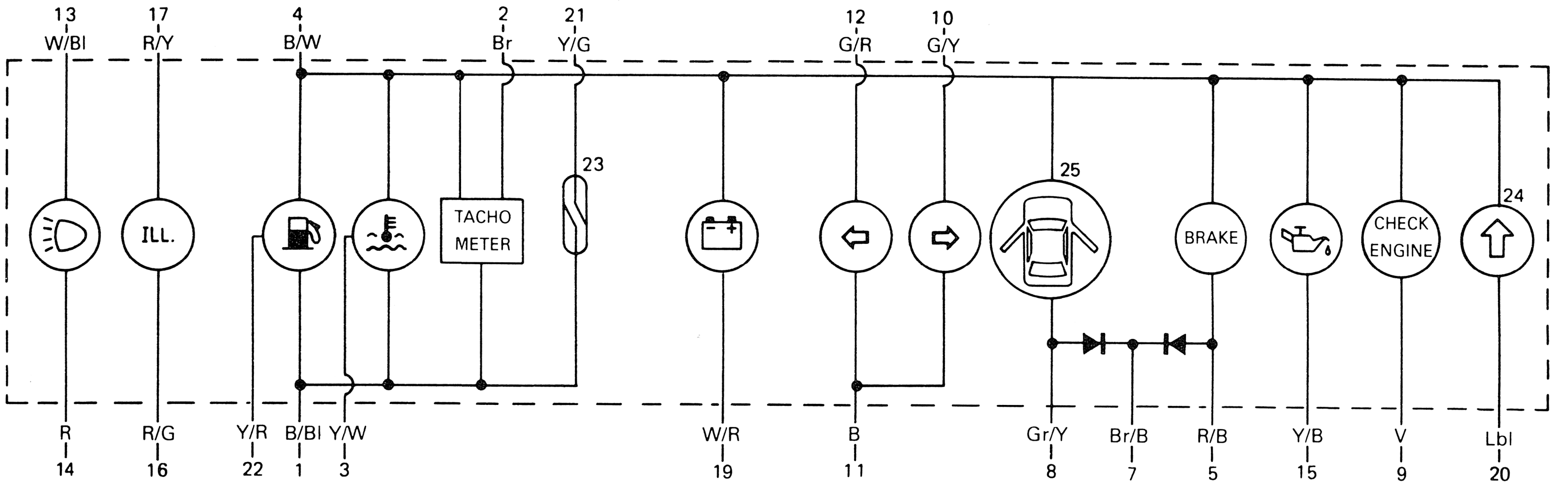

5
F
B/BI
E
6
F
Y/R
4
B/W
3
2
20A
B/BI
W/G
40A
+
−
E
1
1 BATTERY
2 MAIN FUSE
3 IGNITION SWITCH
4 FUSE BLOCK
5 FUEL GAGE
6 SENDING UNIT
W/G : WHITE/GREEN
B/BL : BLACK/BLUE
B/W : BLACK/WHITE
Y/R : YELLOW/RED
B/BL : BLACK/BLUE
KC1354-8-M-RS

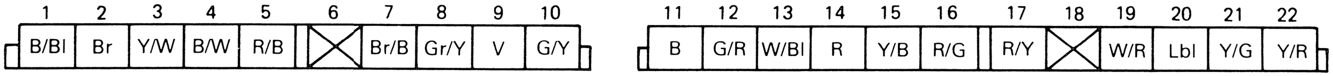
Figure 11 Rheostat Fuel Gage Circuit

DIAGNOSIS

Condition	Possible Cause	Correction
Fuel gage inoperative.	Gage fuse blown.	Replace fuse, check for short.
	Fuel gage faulty.	Check gage.
	Sending unit faulty.	Check sending unit.
	Wiring or faulty ground.	Repair.
Water temperature gage inoperative.	Gage fuse blown.	Replace fuse, check for short.
	Water temperature gage faulty.	Check gage.
	Water temperature sending unit faulty.	Check sending unit.
	Wiring or faulty ground.	Repair.
Brake warning lamp (parking brake lamp) inoperative.	Lamp fuse blown.	Replace fuse, check for short.
	Bulb burnt out.	Replace bulb.
	Brake fluid level switch faulty.	Check warning switch.
	Wiring or faulty ground.	Repair.
Seat belt warning lamp/buzzer inoperative.	Lamp fuse blown.	Replace fuse, check for short.
	Bulb burned out.	Replace bulb.
	Buzzer defective.	Replace buzzer.
	Wiring or faulty ground.	Repair.
Ignition key and light switch warning buzzer inoperative.	Buzzer fuse blown.	Replace fuse, check for short.
	Buzzer faulty.	Replace buzzer.
	Wiring or faulty ground.	Repair.
Shift-up indicator inoperative.	Indicator lamp fuse blown.	Replace fuse and check for short.
(Manual Transmission equipped vehicles only).	Bulb burnt out.	Replace bulb.
	Speedometer faulty.	Check speedometer.


13
W/Bl
17
R/Y
4
B/W
2
Br
21
Y/G
12
G/R
10
G/Y
23
25
24
ILL.
TACHO METER
BRAKE
CHECK ENGINE
R
14
R/G
16
Y/R
22
B/Bl
1
Y/W
3
W/R
19
B
11
Gr/Y
8
Br/B
7
R/B
5
Y/B
15
V
9
Lbl
20

1	TO GROUND
2	TO IGNITION (—)
3	TO WATER TEMPERATURE GAGE
4	TO IGNITION (+)
5	TO BRAKE FLUID LEVER SWITCH & PARKING BRAKE SWITCH
6	NOT USED
7	TO IGNITION SWITCH
8	TO SEAT BELT CONTROL MODULE
9	TO ECM
10	TO TURN SIGNAL SWITCH (RIGHT)
11	TO GROUND
12	TO TURN SIGNAL SWITCH (LEFT)
13	TO FUSE BLOCK
14	TO TURN SIGNAL/DIMMER SWITCH
15	TO OIL PRESSURE SWITCH
16	TO PANEL LIGHTS RHEOSTAT
17	TO LIGHT SWITCH
18	NOT USED
19	TO GENERATOR
20	TO ECM
21	TO ECM
22	TO FUEL GAGE
23	SPEED SENSOR
24	SHIFT-UP INDICATOR LIGHT (M/T MODEL)
25	DOOR WARNING LIGHT


1
B/Bl
2
Br
3
Y/W
4
B/W
5
R/B
6
7
Br/B
8
Gr/Y
9
V
10
G/Y
11
B
12
G/R
13
W/Bl
14
R
15
Y/B
16
R/G
17
R/Y
18
19
W/R
20
Lbl
21
Y/G
22
Y/R

LC0001-8-M-RS

Figure 10 I/P Cluster Wiring

Sending Unit

With an ohmmeter, check to see that the resistance of the unit varies with changes in the float position (Figures 14 and 15).

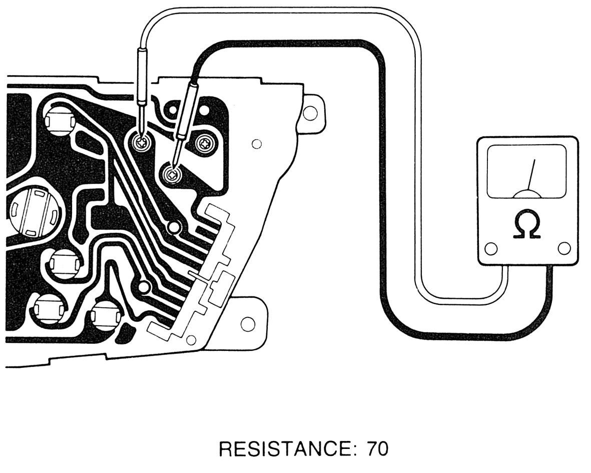


Figure 13 Checking Fuel Gage Coil

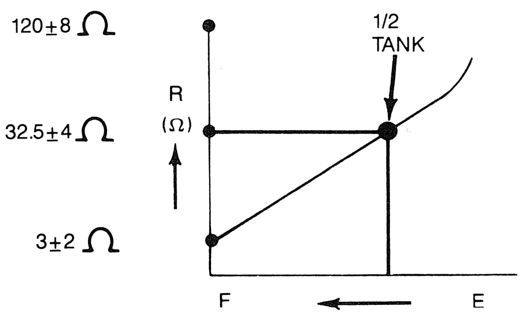
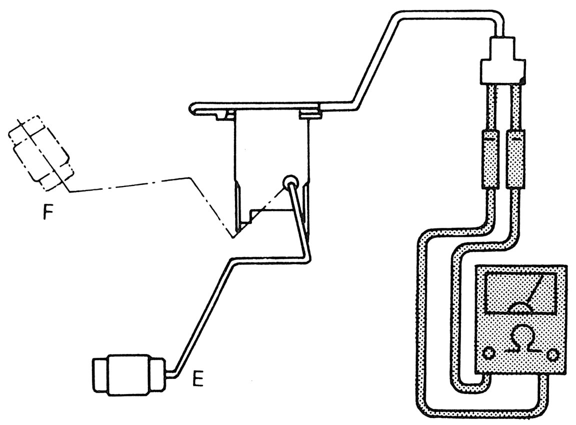


Figure 14 Sending Unit Resistance



F: FULL
E: EMPTY

Position	Resistance
E	120± 8 Ω
F	3 ± 2 Ω
1/2	32.5 ± 4 Ω

Figure 15 Checking Sending Unit

WATER TEMPERATURE GAGE

Description of Circuit

The water temperataure gage circuit consists of the temperature gage installed in the cluster and the sending unit installed in the intake manifold.

The sending unit shows different resistance valves depending on the coolant temperature. This causes the current flowing through the temperature gage coil to change, controlling the gage pointer. That is, when the coolant temperature increases, the sending unit resistance decreases with more current flowing through the gage coil, raising the gage pointer upward from the "C" position (Figure 16).

Remove or Disconnect

1. Negative battery cable.
2. Electrical leads from sending unit (yellow/white).

Inspect (Figures 17 and 18)

- Connect negative battery cable.
- Use a bulb in position to ground the above wire (Figure 17).
- Turn the ignition switch ON. Confirm that the bulb is ON with the gage pointer fluctuating several seconds thereafter. If the pointer is faulty, remove the temperature gage to check it.
- Measure the resistance between the temperature U/W lead wire terminal (A) and (B) (Figure 18).
- If the temperature gage does not meet specifications, replace gage.
- Disconnect negative battery cable.

Install or Connect

1. Electrical leads to sending unit.
2. Negative battery cable.

Sending Unit

Warm up the sending unit (Figure 19). Its resistance should decrease with an increase in temperature. The temperature and resistance relationship can be plotted in a graph (Figure 20).

OIL PRESSURE LIGHT

Description of Circuit

The oil pressure light circuit consists of the oil pressure switch installed in the cylinder block and the light (warning light) inside the cluster. The oil pressure switch is open when oil pressure is produced.

Oil Pressure Switch

Inspect (Figure 22)

1. Oil pressure switch for proper continuity (Figure 22).
2. If check results are not satisfactory, the switch must be replaced.

BRAKE FLUID LEVEL WARNING LIGHT

Description of Circuit (Figure 23)

The brake fluid level warning light circuit consists of a brake fluid level switch installed in the master cylinder reservoir, a brake fluid level warning light in the gage cluster, a diode, and a check relay (Figure 23).

Also, this circuit includes a parking brake switch which warns that the parking brake is applied (Figure 23).

Operation of Warning Light

1. When the engine is stopped, the warning lamp comes on if the ignition switch is turned ON and the parking brake is applied.
2. For bulb check, the warning lamp comes on briefly during engine starting regardless of the brake fluid level position and the parking brake operation because the contacts of the check relay are closed.
3. After the engine is started, release the parking brake. If the lamp goes off, the brake fluid level is adequate.

Brake Fluid Level Switch

Inspect (Figure 24)

1. Use an ohmmeter to measure the switch for resistance and continuity. If found defective, replace the switch (Figure 24).

SEAT BELT WARNING LIGHT AND BUZZER

Description of Circuit

The seat belt warning light buzzer circuit is a system designed to light and sound the buzzer respectively for several seconds, urging the driver to wear his seat belt. When ignition switch is turned ON, the warning light comes ON for several seconds whether the seat belt is fastened or not. After several seconds, the light goes OFF. When ignition switch is turned ON with the seat belt unfastened, the warning buzzer sounds for several seconds.

When the warning light/buzzer does not operate, use the Circuit Diagram as a reference to check the bulb, buzzer, wiring, etc. (Figure 25).

Inspect (Figures 25 and 26)

1. Connect negative terminal of the battery to buzzer terminals (1) and (7), and the positive terminal of the battery to buzzer terminals (4) and (5) (Figure 26).
2. Check that the buzzer emits a buzzing sound for 4 to 8 seconds and stops. If check result is not satisfactory, the buzzer must be replaced.

IGNITION SWITCH KEY WARNING BUZZER

Description of Circuit

The ignition key warning buzzer circuit is a system designed to sound the buzzer if the driver leaves the car with the ignition switch key inserted in place. That is, when the left front door is opened with the ignition switch key in "ACC" or "OFF" position, the warning buzzer sounds.

If the ignition switch key warning buzzer does not sound, use the Wiring Diagram as reference to check the buzzer, wiring, etc. (Figure 27).

Inspect (Figures 27 and 28)

1. Connect negative terminal of the battery to buzzer terminal (6) and (7), and the positive terminal of the battery to buzzer terminal (4) (Figure 28).
2. Buzzer should emit a continuous buzzing sound. If check result is not satisfactory, the buzzer must be replaced.

LIGHT SWITCH WARNING BUZZER

The light switch warning buzzer circuit is a system designed to sound the buzzer if the driver stops the engine with the light switch (headlamps and/or parking lamp) turned ON. That is, when the ignition key is turned from "ON" position to "ACC" or "OFF" position with the light switch turned ON, the warning buzzer sounds (Figure 29).

If the light switch warning buzzer does not sound, use the Wiring Diagram as reference to check the buzzer, switch, wiring, etc. (Figure 29).

Inspect (Figures 29 and 30)

1. Connect the positive terminal of the battery to buzzer terminals (2) and (5) and the negative terminal of the battery to buzzer terminal (7). Then disconnect connection to buzzer terminal (5) (Figure 30).
2. The buzzer should emit a continuous buzzing sound. If check result is not satisfactory, the buzzer must be replaced.

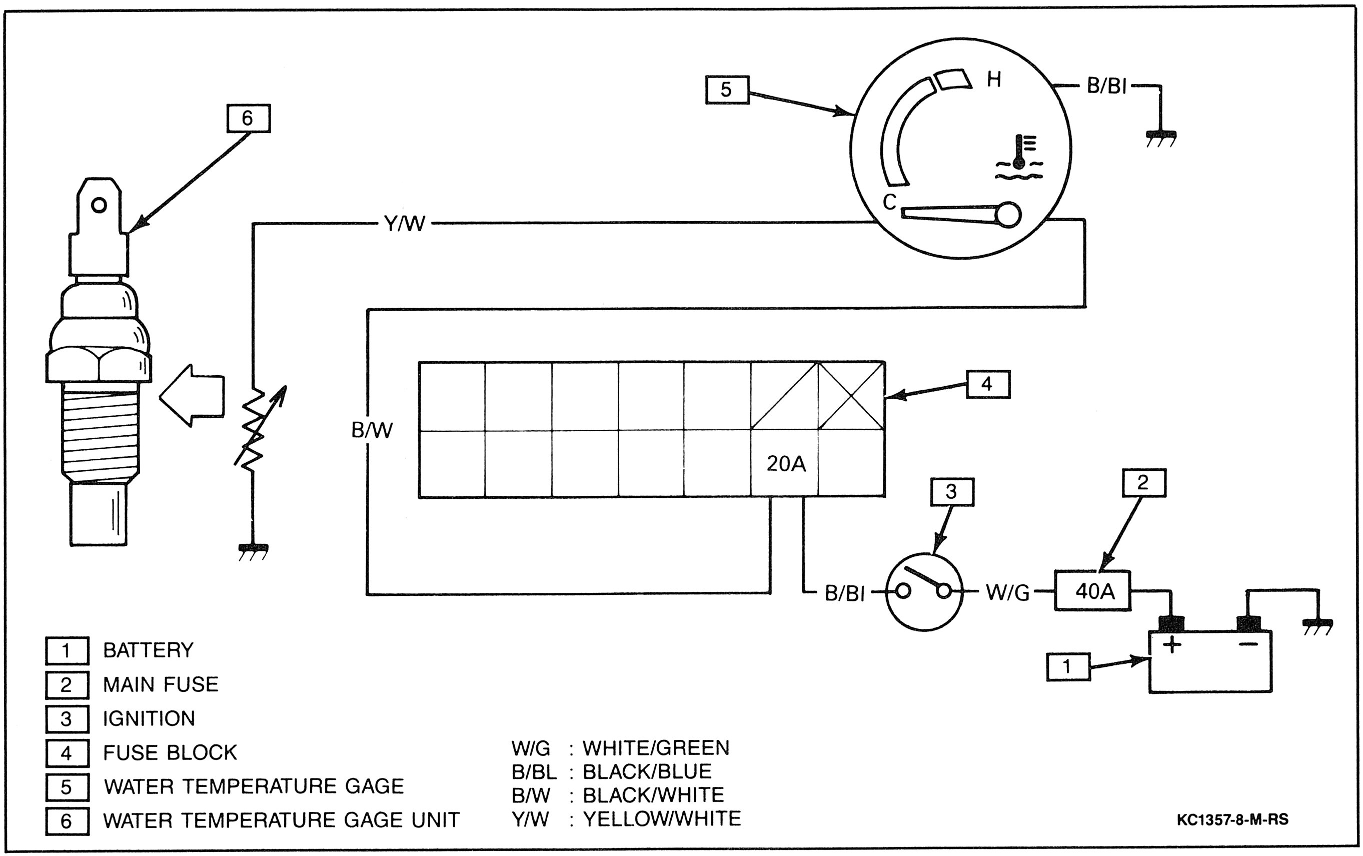

6
5
H
B/BI
C
Y/W
B/W
4
20A
3
2
B/BI
W/G
40A
+
−
1
1 BATTERY
2 MAIN FUSE
3 IGNITION
4 FUSE BLOCK
5 WATER TEMPERATURE GAGE
6 WATER TEMPERATURE GAGE UNIT
W/G : WHITE/GREEN
B/BL : BLACK/BLUE
B/W : BLACK/WHITE
Y/W : YELLOW/WHITE
KC1357-8-M-RS

Figure 16 Water Temperature Gage Circuit

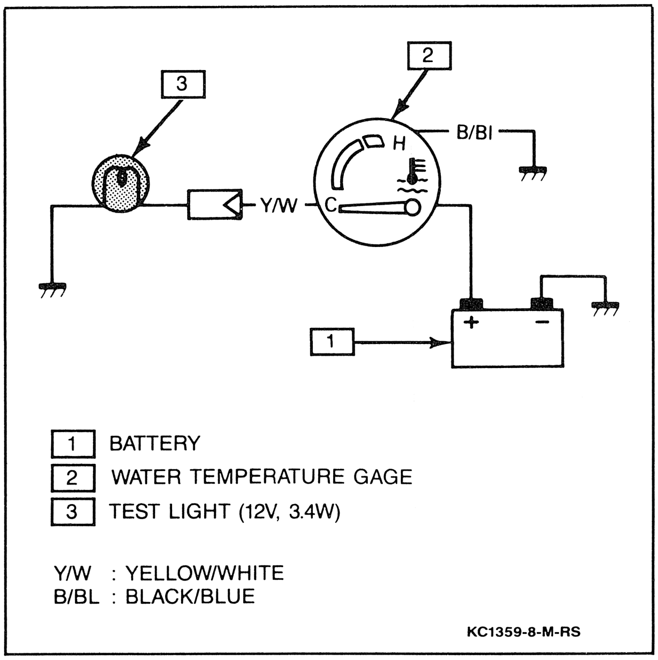

3
2
H
B/BI
Y/W
C
+
−
1
1 BATTERY
2 WATER TEMPERATURE GAGE
3 TEST LIGHT (12V, 3.4W)
Y/W : YELLOW/WHITE
B/BL : BLACK/BLUE
KC1359-8-M-RS

Figure 17 Checking Temperature Gage

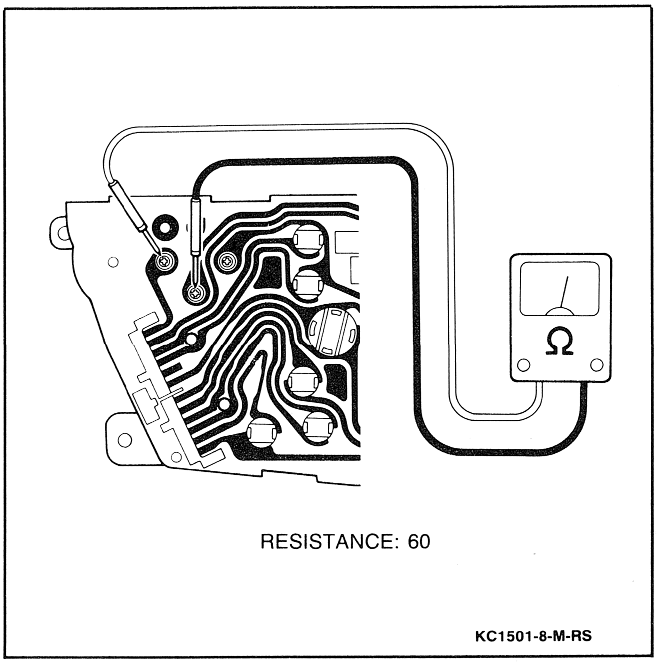

Ω
RESISTANCE: 60
KC1501-8-M-RS

Figure 18 Measuring Water Temperature Gage Resistance

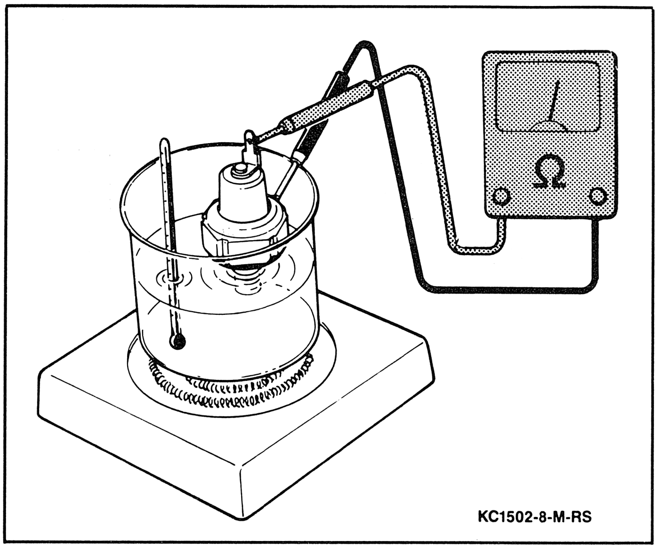
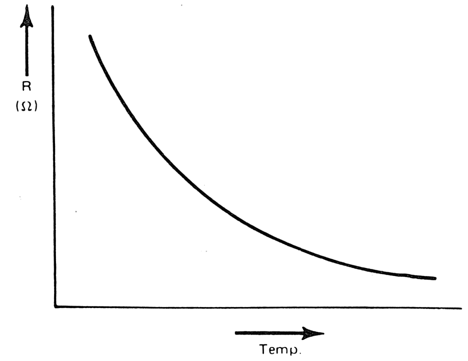

Ω
KC1502-8-M-RS

Figure 19 Checking Temperature Gage Sending Unit



Temperature	Resistance
50°C (122° F)	133.9 ∼ 178.9 Ω
80°C (176° F)	47.5 ∼ 56.8 Ω
100°C (212° F)	26.2 ∼ 29.3 Ω

KC1361-8-M-RS

Figure 20 Temperature Gage Resistance

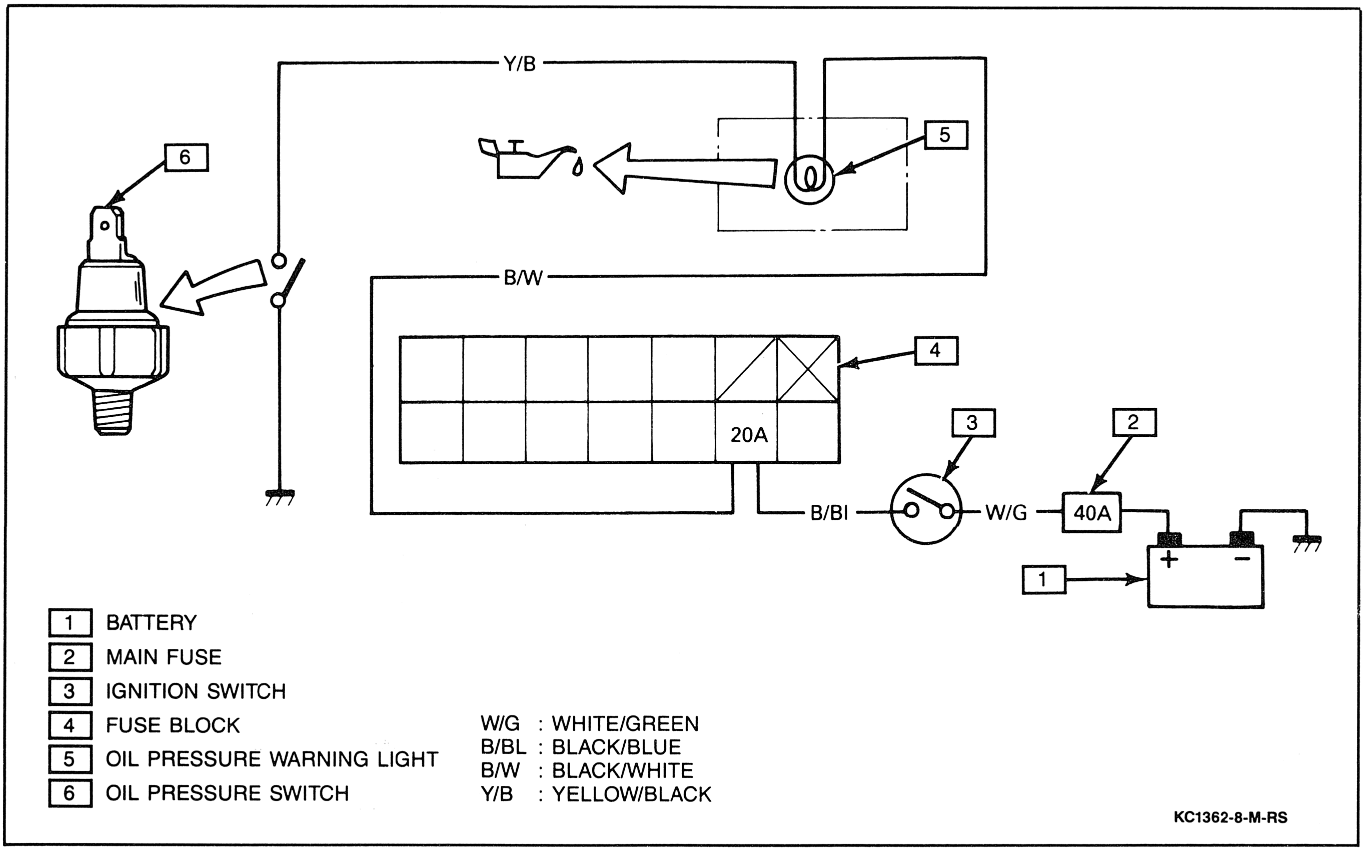

Y/B
5
6
B/W
4
20A
3
2
B/Bl
W/G
40A
+
−
1
1 BATTERY
2 MAIN FUSE
3 IGNITION SWITCH
4 FUSE BLOCK
5 OIL PRESSURE WARNING LIGHT
6 OIL PRESSURE SWITCH
W/G : WHITE/GREEN
B/BL : BLACK/BLUE
B/W : BLACK/WHITE
Y/B : YELLOW/BLACK
KC1362-8-M-RS

Figure 21 Oil Pressure Switch Circuit

Engine Running	No Continuity
Engine Stop	Continuity

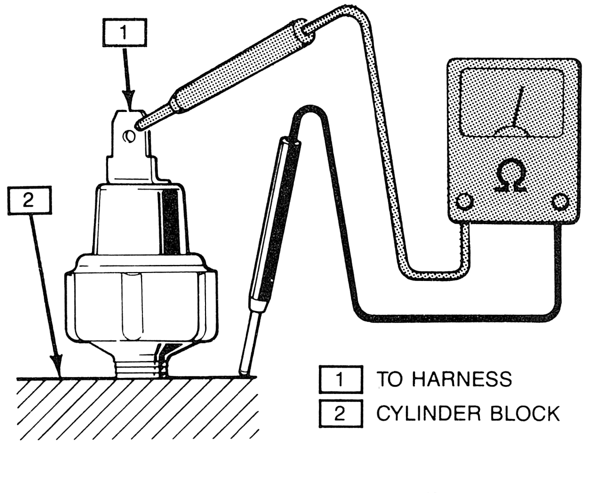

1
2
Ω
1 TO HARNESS
2 CYLINDER BLOCK
KC1503-8-M-RS

Figure 22 Checking Oil Pressure Switch

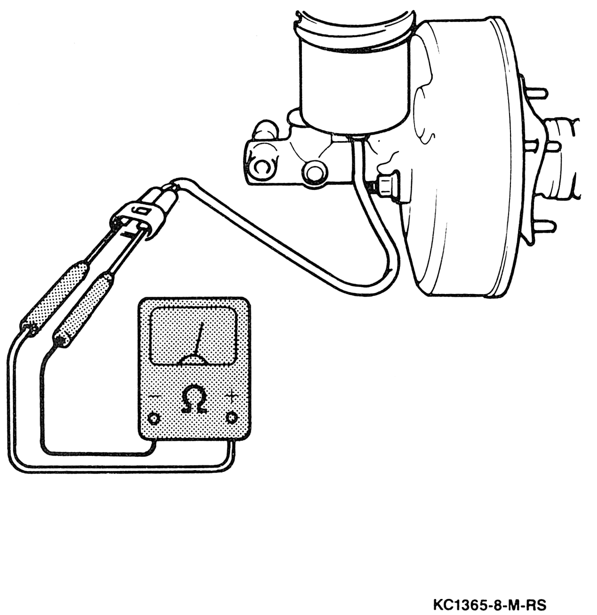

Ω
KC1365-8-M-RS

Figure 24 Checking Brake Fluid Level Switch Resistance

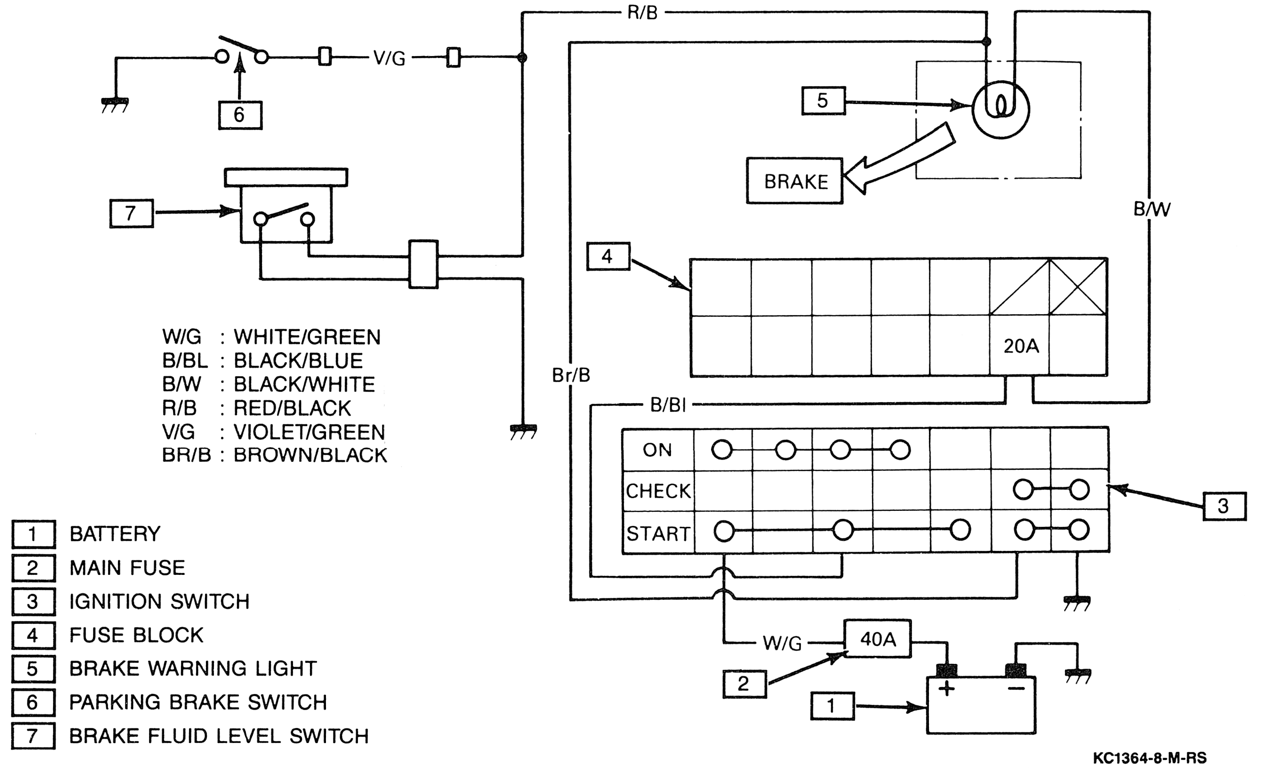

R/B
V/G
6
5
BRAKE
7
B/W
4
20A
Br/B
B/Bl
ON
CHECK
START
3
W/G
40A
2
1
+
−
W/G : WHITE/GREEN
B/BL : BLACK/BLUE
B/W : BLACK/WHITE
R/B : RED/BLACK
V/G : VIOLET/GREEN
BR/B : BROWN/BLACK
1 BATTERY
2 MAIN FUSE
3 IGNITION SWITCH
4 FUSE BLOCK
5 BRAKE WARNING LIGHT
6 PARKING BRAKE SWITCH
7 BRAKE FLUID LEVEL SWITCH
KC1364-8-M-RS

Figure 23 Brake Warning Circuit

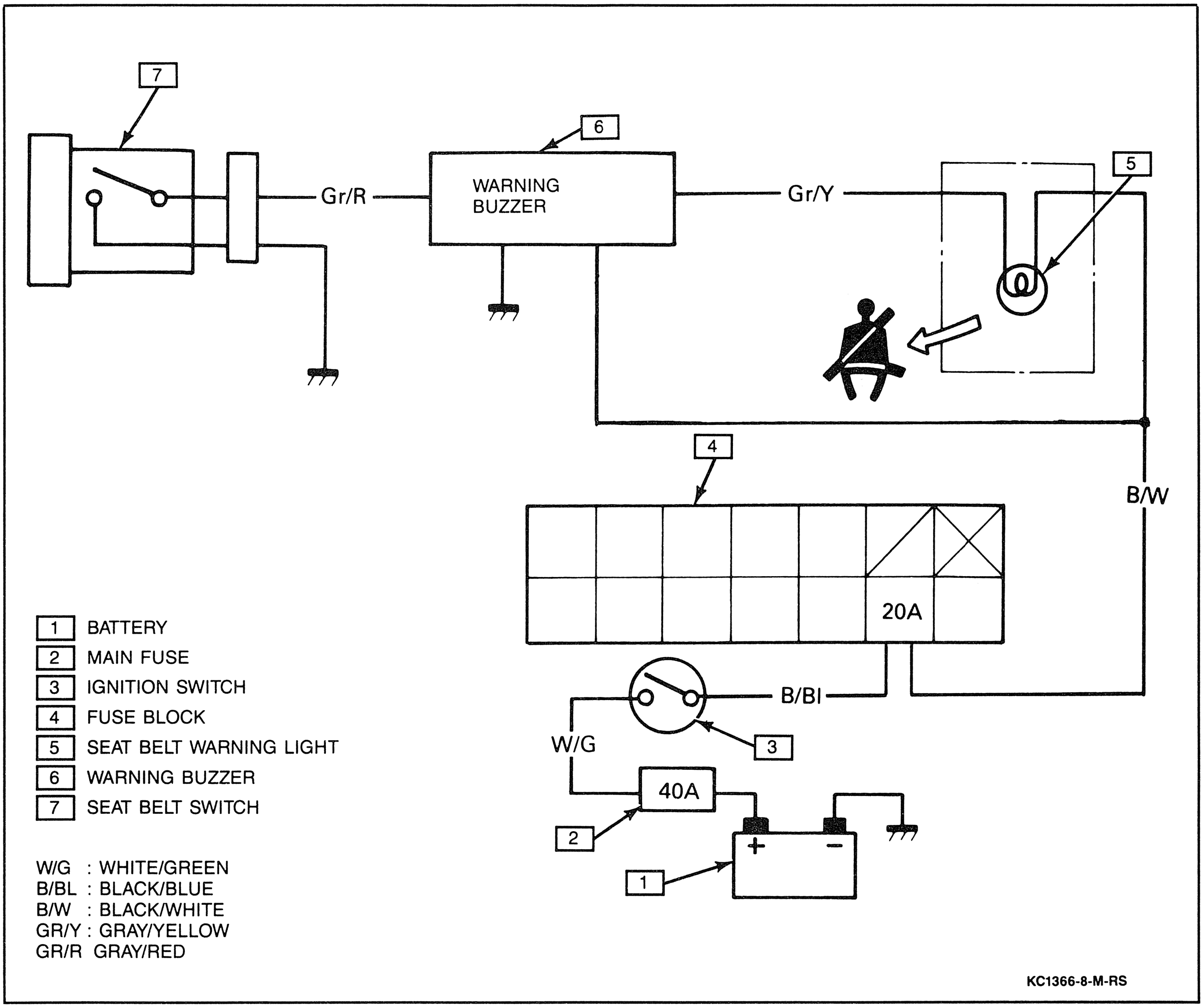

7
6
WARNING BUZZER
Gr/R
Gr/Y
5
4
B/W
20A
B/Bl
W/G
3
40A
2
1
+
−
1 BATTERY
2 MAIN FUSE
3 IGNITION SWITCH
4 FUSE BLOCK
5 SEAT BELT WARNING LIGHT
6 WARNING BUZZER
7 SEAT BELT SWITCH
W/G : WHITE/GREEN
B/BL : BLACK/BLUE
B/W : BLACK/WHITE
GR/Y : GRAY/YELLOW
GR/R GRAY/RED
KC1366-8-M-RS

Figure 25 Seat Belt Warning Circuit

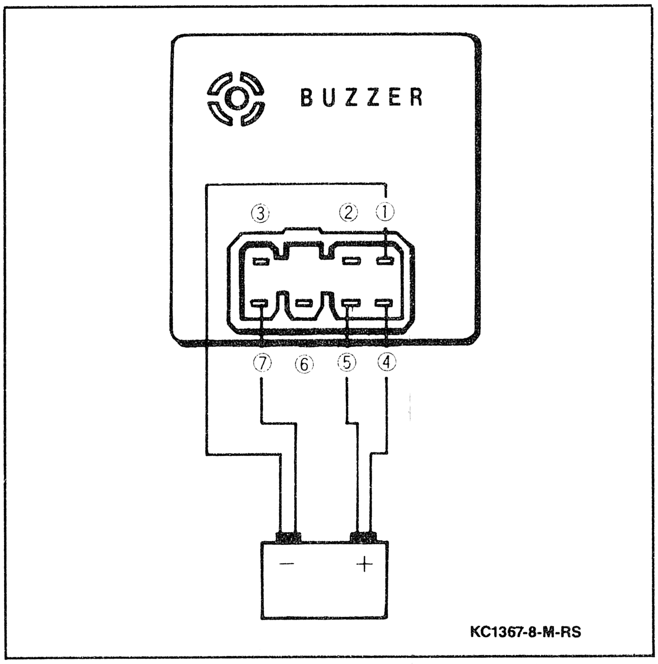

BUZZER
③
②
①
⑦
⑥
⑤
④
−
+
KC1367-8-M-RS

Figure 26 Checking The Seat Belt Warning Buzzer

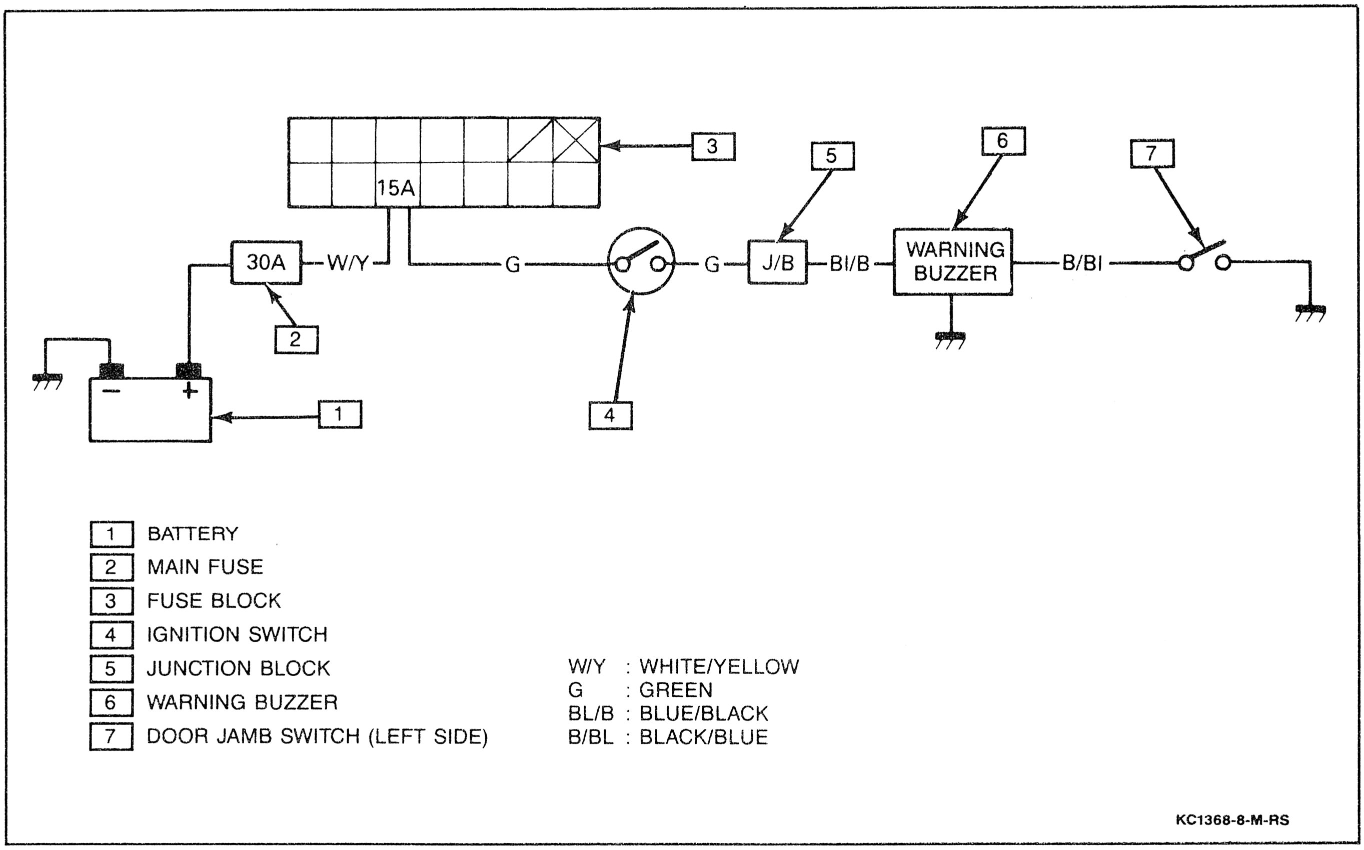

15A
30A
W/Y
G
G
J/B
Bl/B
WARNING BUZZER
B/Bl
−
+
1
2
3
4
5
6
7
1 BATTERY
2 MAIN FUSE
3 FUSE BLOCK
4 IGNITION SWITCH
5 JUNCTION BLOCK
6 WARNING BUZZER
7 DOOR JAMB SWITCH (LEFT SIDE)
W/Y : WHITE/YELLOW
G : GREEN
BL/B : BLUE/BLACK
B/BL : BLACK/BLUE
KC1368-8-M-RS

Figure 27 Ignition Switch Key Warning Buzzer Circuit

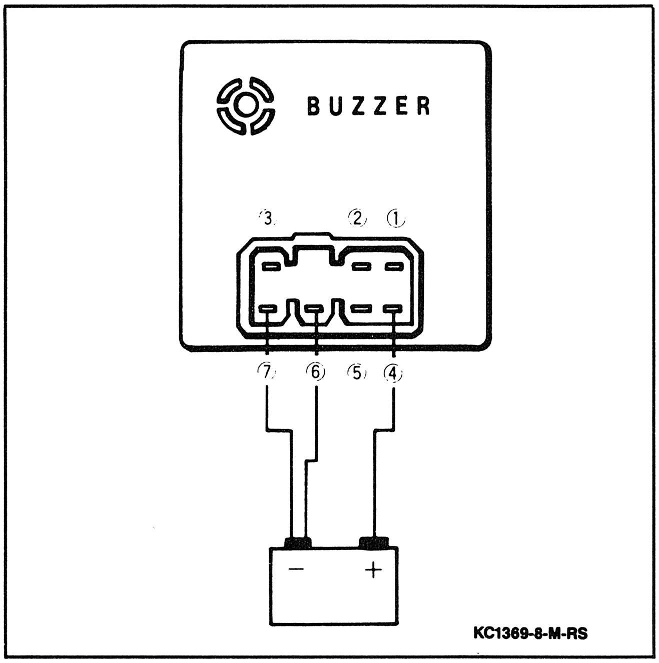

BUZZER
3
2
1
7
6
5
4
−
+
KC1369-8-M-RS

Figure 28 Checking The Ignition Switch Key Warning Buzzer

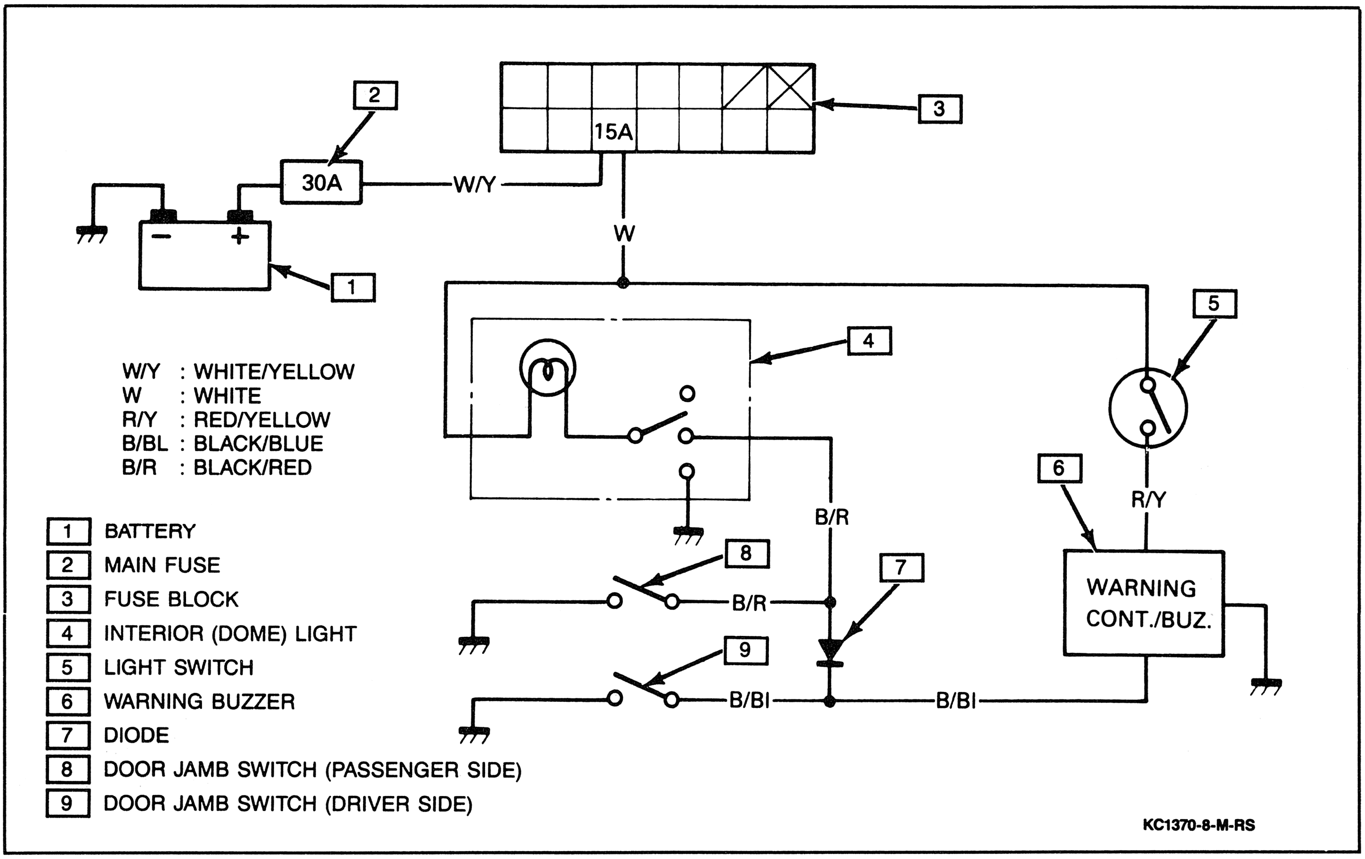

2
30A
W/Y
3
15A
W
1
4
5
6
R/Y
B/R
8
7
B/R
9
B/Bl
B/Bl
WARNING CONT./BUZ.
W/Y : WHITE/YELLOW
W : WHITE
R/Y : RED/YELLOW
B/BL : BLACK/BLUE
B/R : BLACK/RED
1 BATTERY
2 MAIN FUSE
3 FUSE BLOCK
4 INTERIOR (DOME) LIGHT
5 LIGHT SWITCH
6 WARNING BUZZER
7 DIODE
8 DOOR JAMB SWITCH (PASSENGER SIDE)
9 DOOR JAMB SWITCH (DRIVER SIDE)
KC1370-8-M-RS

Figure 29 Light Switch Warning Buzzer Circuit

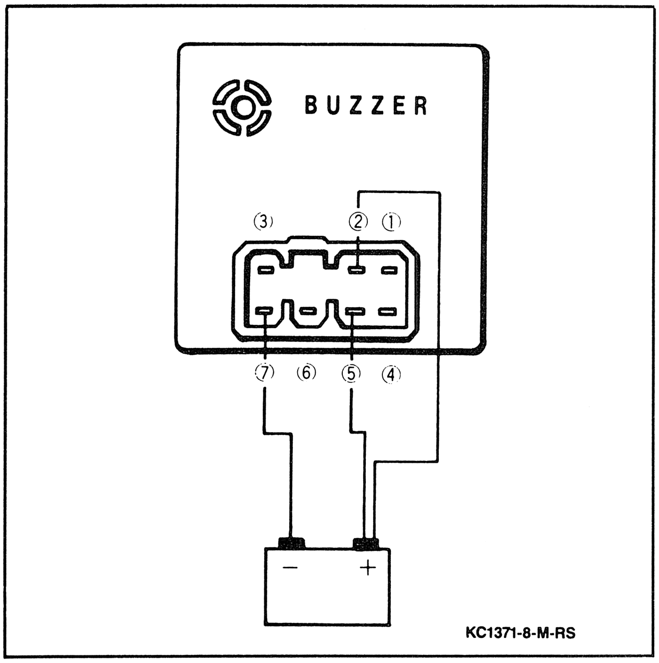


Figure 30 Checking The Light Switch Warning Buzzer

ON-VEHICLE SERVICE

INSTRUMENT PANEL CARRIER ASSEMBLY

Remove or Disconnect (Figure 31)

1. Negative battery cable.
2. Console box, if equipped. Refer to "Console Box" procedure in this section.
3. Instrument cluster. Refer to "Instrument Cluster" procedure in this section.
4. Turn signal/dimmer switch (See section 3F).
5. Heater control panel (See section 10).
6. Hood latch release lever mounting screw and lever from the instrument panel carrier assembly.
7. Two instrument main panel mounting screws from the main panel.

   NOTICE: Remove these screws on both the left and right hand sides.

8. Four attaching screws from the instrument panel support member.
9. Two mounting screws from the heater control assembly.
10. One attaching screw from the rear of the glovebox upper panel.
11. Instrument main panel access cover and one attaching screw at the panel.
12. Left and right hand front speaker garnish covers (See section 9A).
13. One attaching screw at each speaker from the instrument main panel.
14. Two push pins from the left and right hand kick panels and remove panels from the vehicle.
15. One attaching screw from the instrument main panel behind each kick panel.
16. Front speaker electrical connector at the left and right hand speaker.
17. All instrument panel switches (i.e., panel lights rheostat, rear wiper/washer switch, rear window defogger switch, etc.).
18. Instrument panel wire harness from the instrument panel carrier assembly.
19. Instrument panel carrier assembly from the vehicle.
20. Heater control assembly from the vehicle (See section 1B).
21. Seat belt, ignition key, and light switch warning buzzer module (See procedure in this section).
22. Five mounting screws from the instrument panel support member and remove the member from the vehicle.

Install or Connect

1. Instrument panel support member to the vehicle with five mounting screws.
2. Light switch, ignition key, and seat belt warning buzzer module (See procedure in this section).
3. Heater control assembly to the vehicle (See section 1B).
4. Instrument panel carrier assembly to the vehicle.
5. Instrument panel wire harness to the instrument panel carrier assembly.
6. All instrument panel switches (i.e., panel lights rheostat, rear wiper/washer switch, rear window defogger switch, etc.).
7. Front speaker electrical connector at the left and right hand speaker.
8. One attaching screw to the instrument main panel behind each kick panel, and kick panels to vehicle.

9. Two push pins to the left and right hand kick panels.
10. One attaching screw at each speaker to the instrument main panel.
11. Left and right hand front speaker garnish covers (See section 9A).
12. One attaching screw to main instrument panel at access cover and cover to panel.
13. One attaching screw to the rear of the glovebox upper panel.
14. Two mounting screws to the heater control assembly.
15. Four attaching screws to the instrument panel support member.
16. Two instrument main panel mounting screws to the main panel.

NOTICE: Install these screws on both the left and right hand sides.

18. Heater control panel (See section 1B).
19. Turn signal/dimmer switch (See section 3F).
20. Instrument cluster. Refer to "Instrument Cluster" procedure in this section.
21. Console box, if equipped. Refer to "Console Box" procedure in this section.
22. Negative battery cable.

GLOVEBOX

←→ Remove or Disconnect (Figure 31)

1. Three glovebox door mounting screws from the bottom of the door and the door from the instrument panel carrier assembly.
2. Two attaching screws from glovebox latch assembly.
3. Unsnap glovebox latch button from the assembly and remove button and latch assembly from glovebox door.
4. Two mounting screws from the glovebox striker and the striker from the instrument panel carrier assembly.
5. One instrument panel carrier assembly attaching screw from the rear of the glovebox upper panel.
6. Glovebox upper panel from the instrument panel carrier assembly by disengaging three lock tabs at top of the glovebox upper panel.

→← Install or Connect

1. Position glovebox upper panel and engage three lock tabs at top of the panel.
2. One instrument panel carrier assembly attaching screw to the rear of the glovebox upper panel.
3. Striker to the instrument panel carrier assembly and two mounting screws to the glovebox striker.
4. Button and latch assembly to glovebox door and snap glovebox latch button to the assembly.
5. Two attaching screws to the glovebox latch assembly.
6. Glovebox door to the instrument panel carrier assembly and three glovebox door mounting screws to the bottom of the door.

INSTRUMENT CLUSTER

←→ Remove or Disconnect (Figures 31 and 32)

1. Negative battery cable.
2. Four attaching screws from the cluster switch panel.
3. Front windshield wiper/washer switch and light/hazard flasher switch electrical connectors and remove the cluster bezel and switch panel as an assembly.
4. Six attaching screws from the cluster bezel and bezel from the switch panel.
5. Front wiper switch and the light/hazard switch from the switch panel. Refer to "Light/Hazard Warning Switch" procedure in this section.
6. Four cluster housing mounting screws from the housing.
7. Two electrical connectors and the speedometer cable from the rear of the cluster housing.
8. Cluster assembly from the vehicle.
9. Cluster lens from the cluster housing.

→← Install or Connect

1. Cluster lens to the cluster housing.
2. Cluster assembly to the vehicle.
3. Speedometer cable and two electrical connectors to the rear of the cluster housing.
4. Four cluster housing mounting screws to the housing.
5. Light/hazard flasher switch and front windshield wiper/washer switch to the switch panel. Refer to "Light/Hazard Warning Switch" procedure in this section.
6. Cluster bezel to the switch panel as an assembly to the vehicle, and six attaching screws to the bezel.
7. Electrical connectors to wiper switch and light/hazard flasher switches, and install cluster bezel and switch panel.
8. Four attaching screws into cluster switch panel.
9. Negative battery cable.

INSTRUMENT CLUSTER PRINTED CIRCUIT

←→ Remove or Disconnect (Figure 32)

1. Negative battery cable.
2. Instrument cluster. Refer to "Instrument Cluster" procedure in this section.
3. Eight gage and speedometer mounting screws from the cluster housing.
4. All indicator lights from the cluster housing by turning counterclockwise and pulling straight out.
5. Instrument cluster printed circuit from the cluster housing.

→← Install or Connect

1. Instrument cluster printed circuit to the cluster housing.
2. All indicator lights to the cluster by pushing in and turning clockwise.

3. Eight gage and speedometer screws to the cluster housing.
4. Instrument cluster (See procedure in this section).
5. Negative battery cable.

SPEEDOMETER HEAD

Remove or Disconnect (Figure 32)

1. Negative battery cable.
2. Instrument cluster.
3. Four speedometer head mounting screws from the cluster housing.
4. Speedometer window retainer from the cluster housing.
5. Speedometer head from the cluster housing.

Install or Connect

1. Speedometer head to the cluster housing.
2. Speedometer window retainer to the cluster housing.
3. Four speedometer head mounting screws to the cluster housing.
4. Instrument cluster.
5. Negative battery cable.

TACHOMETER

Tachometer and speedometer head are removed as an assembly. See steps 1 through 5 of Speedometer Head replacement (Figure 32). Speedometer and tachometer head assembly must be replaced.

FUEL GAGE AND WATER TEMPERATURE GAGE

Remove or Disconnect

1. Negative battery cable.
2. Instrument cluster.
3. Three fuel and/or water temperature gage mounting screws from the cluster housing.
4. Speedometer head.
5. Fuel and/or water temperature gage from the cluster housing.

NOTICE: The fuel and water temperature gages are not serviceable. If gage is found to be defective, it must be replaced.

Install or Connect

1. Fuel and/or water temperature gage to the cluster housing.
2. Three fuel and/or water temperature gage mounting screws to the cluster housing.
3. Speedometer head.
4. Instrument cluster.
5. Negative battery cable.

FRONT WINDSHIELD WIPER/WASHER SWITCH

Remove or Disconnect

1. Negative battery cable.
2. Cluster switch panel from the cluster bezel.
3. Two wiper switch mounting screws and the switch from the cluster switch panel.
4. Two attaching screws from the switch housing and remove the housing from the switch assembly.

Install or Connect

1. Switch assembly to switch housing and two attaching screws to the housing.
2. Wiper switch and two switch mounting screws to the cluster switch panel.
3. Cluster bezel to the cluster switch panel.
4. Negative battery cable.

LIGHT/HAZARD FLASHER SWITCH

Remove or Disconnect (Figure 33)

1. Negative battery cable.
2. Cluster switch panel from the cluster bezel.
3. Two light/hazard flasher switch mounting screws and the switch from the cluster switch panel.
4. Two attaching screws from the switch housing and remove the housing from the switch assembly.

Install or Connect

1. Switch assembly to housing and two attaching screws to the switch housing.
2. Switch to the cluster switch panel and two light/hazard screws to the switch.
3. Cluster switch panel to the cluster bezel.
4. Negative battery cable.

PARKING BRAKE LIGHT SWITCH

Remove or Disconnect

1. Negative battery cable.
2. Parking brake lever cover.
3. Parking brake light switch electrical connector.
4. One mounting screw and the switch from the parking brake lever.

Install or Connect

1. The switch and one mounting screw to the parking brake lever.

2. Parking brake light switch electrical connector.
3. Parking brake lever cover.
4. Negative battery cable.

FLASHER (TURN AND HAZARD)

Remove or Disconnect (Figure 33)

1. Negative battery cable.
2. Flasher, located near the junction/fuseblock.

Install or Connect

1. Flasher to the vehicle.
2. Negative battery cable.

SEAT BELT, IGNITION SWITCH KEY, AND LIGHT SWITCH WARNING BUZZER MODULE

Remove or Disconnect (Figure 33)

1. Negative battery cable.
2. Lower steering column panel to gain access to the module (See section 3F).
3. Warning buzzer module electrical connector.

4 One mounting screw from the warning buzzer module and the module from the instrument panel support member.

NOTICE: The warning module is located behind the hood latch release lever.

Install or Connect

1. Warning buzzer module to the instrument panel support member and install one mounting screw to the module.
2. Warning buzzer module electrical connector.
3. Lower steering column panel (See section 3F).
4. Negative battery cable.

PANEL LIGHTS RHEOSTAT

Remove or Disconnect (Figure 33)

1. Negative battery cable.
2. Lower steering column panel to gain access to the rheostat (See section 3F).
3. Rheostat electrical connector.
4. Rheostat adjusting knob, retaining nut, washer, and trim plate from the rheostat housing.
5. Rheostat through the rear of the instrument panel.

Install or Connect

1. Rheostat through the rear of the instrument panel.
2. Trim plate, washer, retaining nut, and rheostat adjusting knob to the rheostat housing.
3. Rheostat electrical connector.
4. Lower steering column panel (See section 3F).
5. Negative battery cable.

REAR WIPER/WASHER SWITCH

Remove or Disconnect (Figure 33)

1. Negative battery cable.
2. Lower steering column to gain access to rear wiper switch (See section 3F).
3. Rear wiper/washer switch electrical connector.
4. Disengage lock tabs of rear wiper switch and remove through the front of the instrument panel.

Install or Connect

1. Rear wiper switch through the front of the instrument panel and engage lock tabs.
2. Electrical connector.
3. Lower steering column panel (See section 3F).
4. Negative battery cable.

REAR WINDOW DEFOGGER SWITCH

Remove or Disconnect (Figure 33)

1. Negative battery cable.
2. Disengage lock tabs of rear window defogger switch and remove panel through the front of the instrument cluster switch panel.
3. Rear window defogger switch electrical connector.
4. Switch from vehicle.

Install or Connect

1. Switch to vehicle.
2. Electrical connector.
3. Switch through the front of the instrument cluster switch panel and engage lock tabs.
4. Negative battery cable.

RADIO RECEIVER

Remove or Disconnect

1. Battery negative (–) cable.
2. Glove box cover.
3. One bolt from rear of radio.
4. Radio from instrument panel by reaching through glove and pushing radio straight out.
5. Antenna lead from rear of radio.
6. Radio electrical connector.
7. Radio from vehicle.

Install or Connect

1. Radio to vehicle.
2. Radio electrical connector.
3. Antenna lead to rear of radio.
4. Radio to instrument panel by pushing radio straight in.
5. One bolt to rear of radio.
6. Glove box cover.
7. Battery negative (–) cable.

STOPLAMP SWITCH

Remove or Disconnect

1. Negative battery cable.
2. Lower steering column shaft cover to gain access to the switch (See section 3F).
3. Stoplamp switch electrical connector.
4. One adjusting nut, and unscrew switch from the lower steering column support member.

Install or Connect

1. Screw switch to the lower steering column support member and one adjusting nut.
2. Stoplamp switch electrical connector.
3. Lower steering column shaft cover (See section 3F).
4. Negative battery cable.

CONSOLE (AUTOMATIC TRANSAXLE ONLY)

Remove or Disconnect (Figure 34)

1. Four attaching screws from the console box, and the box by gently pulling outward at bottom to disengage two retaining pins.

NOTICE: The shift control lever should be placed in the LOW gear position to gain clearance for console box removal.

2. Two attaching screws from the parking brake lever cover and remove the cover.

NOTICE: Both front seats should be moved all the way forward to gain access to the parking brake lever bezel attaching screws.

3. Four attaching screws from the shift control lever console.
4. Park lock-out knob from the shift control lever console, if equipped.
5. Console from vehicle.

NOTICE: The parking brake lever should be engaged to provide ease of shift control lever console and parking brake lever cover removal.

Install or Connect

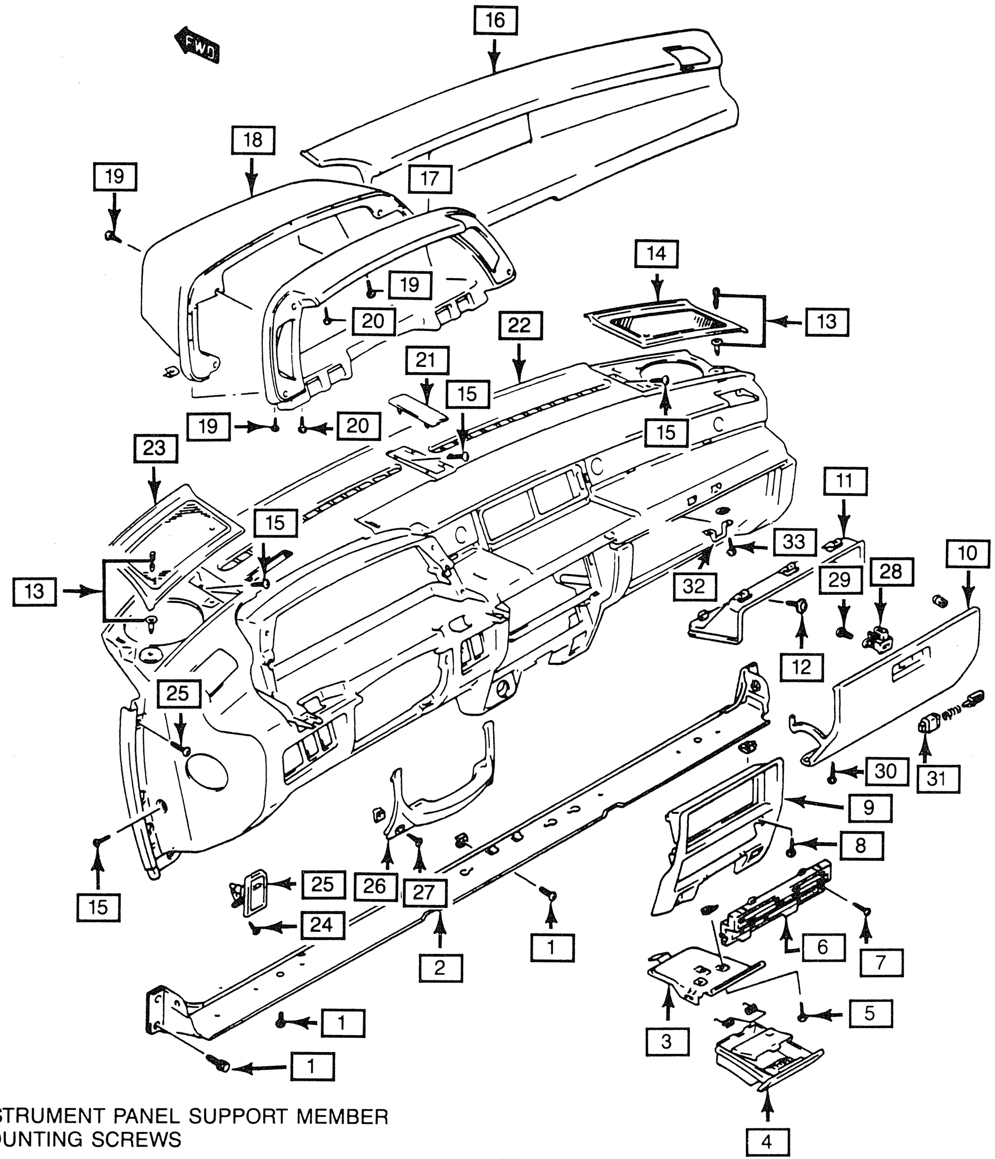
1. Console to the vehicle.
2. Park lock out knob to the shift control lever console, if equipped.
3. Four attaching screws to the shift control lever console.
4. Parking brake lever bezel to the vehicle and two attaching screws to the bezel.
5. Console box, by gently engaging two retaining pins at the bottom of the box.
6. Four attaching screws to the console box.

LIGHTING SYSTEMS

HEADLAMPS

WIRING CIRCUIT DIAGNOSIS

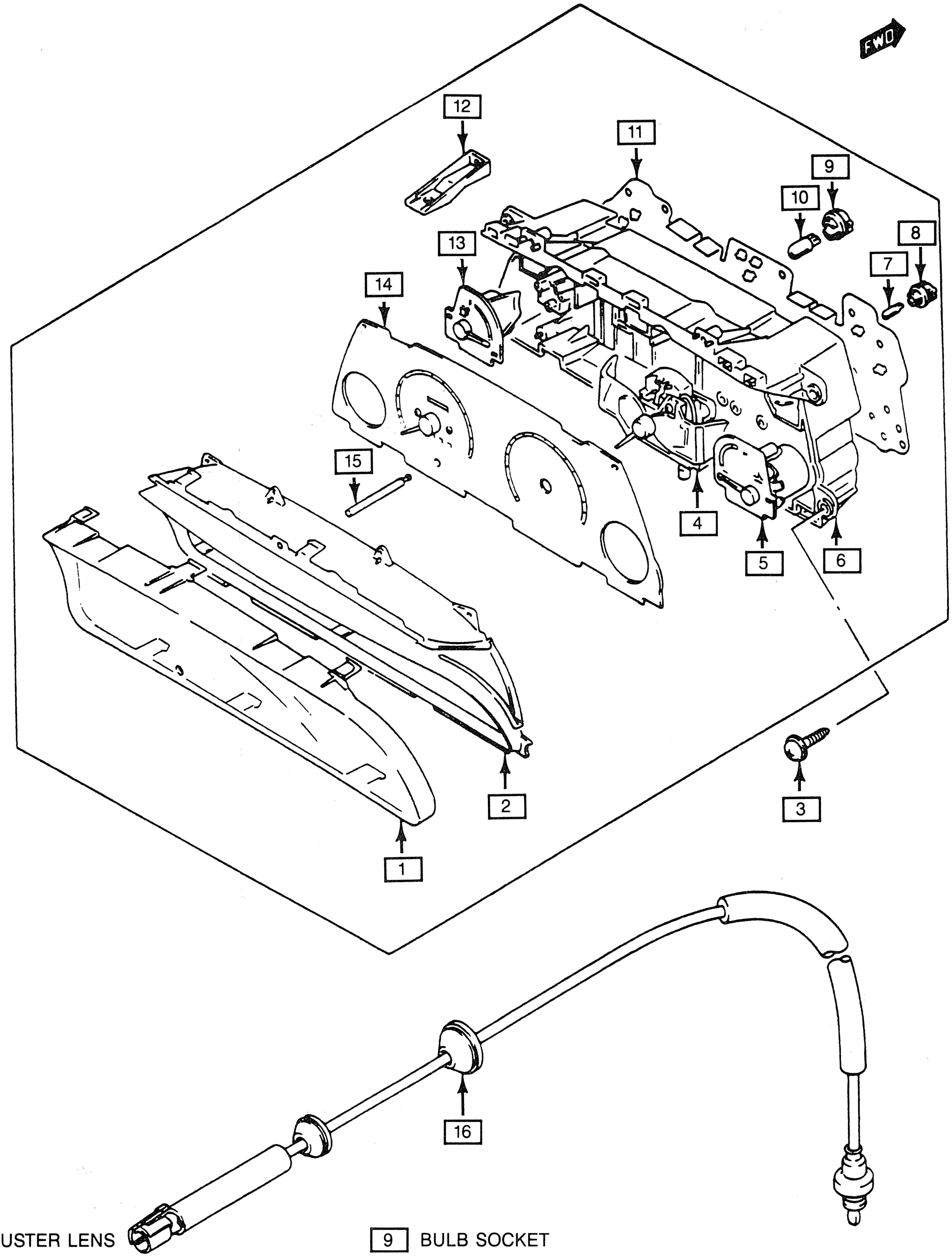
When the headlamps are on, the park lamps are also on. See the following pages for park lamp circuity (Figure 35).



1	INSTRUMENT PANEL SUPPORT MEMBER MOUNTING SCREWS
2	INSTRUMENT PANEL SUPPORT MEMBER
3	ASHTRAY UPPER PLATE
4	ASHTRAY ASSEMBLY
5	ASHTRAY UPPER PLATE ATTACHING SCREW
6	HEATER CONTROL PANEL
7	HEATER CONTROL PANEL MOUNTING SCREW
8	INSTRUMENT PANEL BEZEL ATTACHING SCREW
9	INSTRUMENT PANEL BEZEL
10	GLOVE BOX DOOR
11	GLOVE BOX UPPER PANEL
12	GLOVE BOX UPPER PANEL ATTACHING SCREW
13	GARNISH COVER PUSH PINS
14	(RH) FRONT SPEAKER GARNISH COVER
15	INSTRUMENT MAIN PANEL ATTACHING SCREWS
16	INSTRUMENT PANEL PAD
17	CLUSTER SWITCH PANEL
18	CLUSTER BEZEL
19	CLUSTER BEZEL ATTACHING SCREWS
20	CLUSTER SWITCH PANEL ATTACHING SCREWS
21	INSTRUMENT MAIN PANEL ACCESS PANEL
22	INSTRUMENT MAIN PANEL
23	(LH) FRONT SPEAKER GARNISH PANEL
24	HOOD LATCH RELEASE LEVER MOUNTING SCREW
25	HOOD LATCH RELEASE LEVER ASSEMBLY
26	LOWER STEERING COLUMN PANEL
27	LOWER STEERING COLUMN PANEL ATTACHING SCREW
28	GLOVEBOX LATCH ASSEMBLY
29	GLOVEBOX LATCH ASSEMBLY ATTACHING SCREW
30	GLOVEBOX DOOR MOUNTING SCREW
31	GLOVEBOX LATCH BUTTON
32	GLOVEBOX STRIKER
33	GLOVEBOX STRIKER MOUNTING SCREW

KC1425-8-M-RS

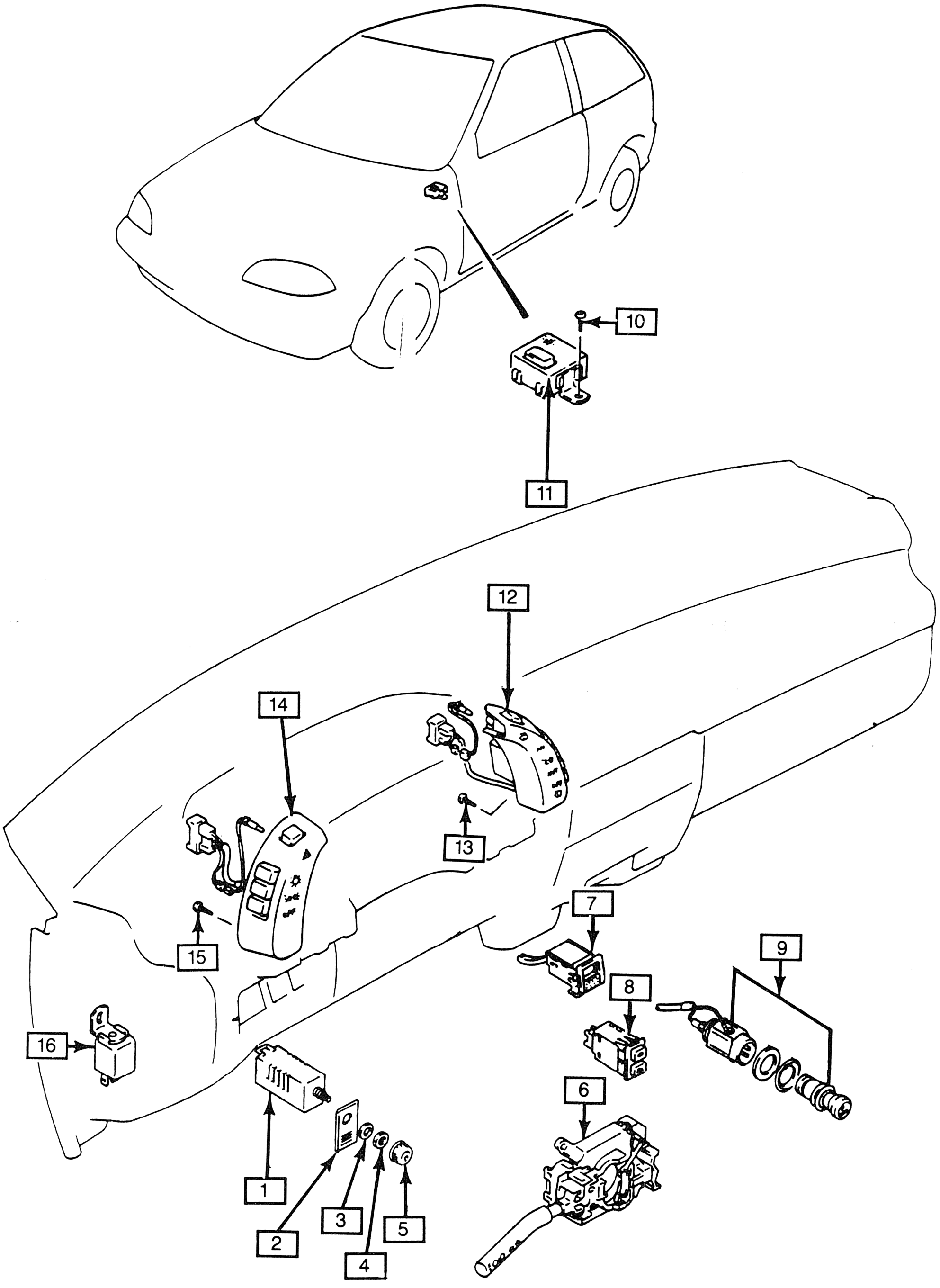
Figure 31 Instrument Panel Expolded View



1 CLUSTER LENS
2 SPEEDOMETER WINDOW RETAINER
3 CLUSTER HOUSING MOUNTING SCREW
4 TACHOMETER
5 WATER TEMPERATURE GAGE
6 CLUSTER HOUSING
7 CLUSTER INDICATOR BULB (12V, 1.4W)
8 BULB SOCKET
9 BULB SOCKET
10 CLUSTER ILLUMINATION BULB (12V, 3.4W)
11 CLUSTER PRINTED CIRCUIT BOARD
12 CLUSTER HOUSING ATTACHING BRACKET
13 FUEL GAGE
14 SPEEDOMETER HEAD ASSEMBLY
15 TRIP ODOMETER KNOB
16 SPEEDOMETER CABLE ASSEMBLY

KC1426-8-M-RS

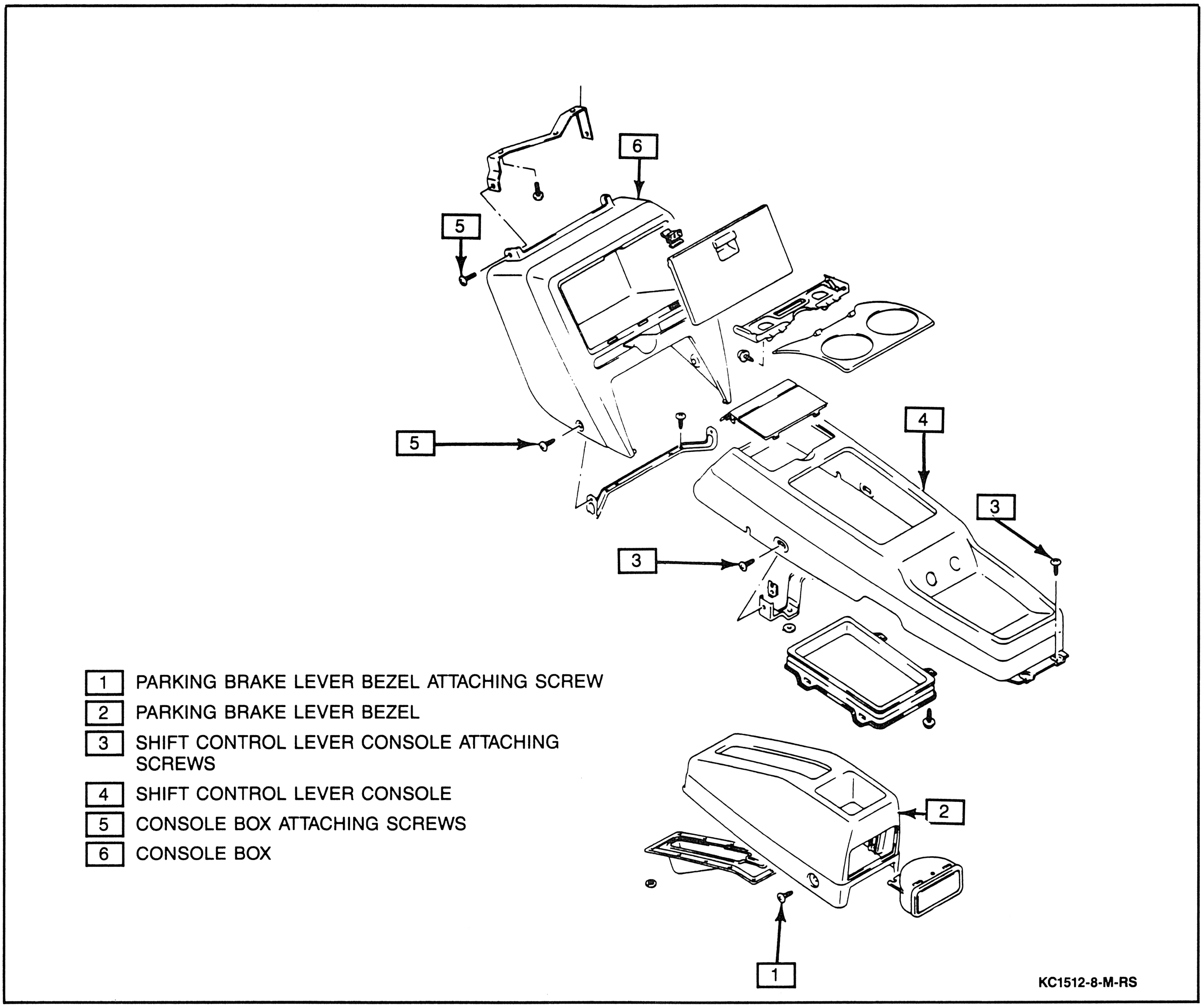
Figure 32 Cluster Disassembly



1	RHEOSTAT HOUSING	9	CIGAR LIGHTER ASSEMBLY
2	RHEOSTAT TRIM PLATE	10	WARNING BUZZER MODULE MOUNTING SCREW
3	WASHER	11	WARNING BUZZER MODULE
4	RHEOSTAT RETAINING NUT	12	FRONT WINDSHIELD WIPER SWITCH
5	RHEOSTAT ADJUSTING KNOB	13	ATTACHING SCREW
6	TURN SIGNAL/DIMMER SWITCH	14	LIGHT/HAZARD FLASHER SWITCH
7	REAR DEFOGGER SWITCH	15	ATTACHING SCREW
8	REAR WIPER/WASHER SWITCH	16	FLASHER (TURN AND HAZARD)

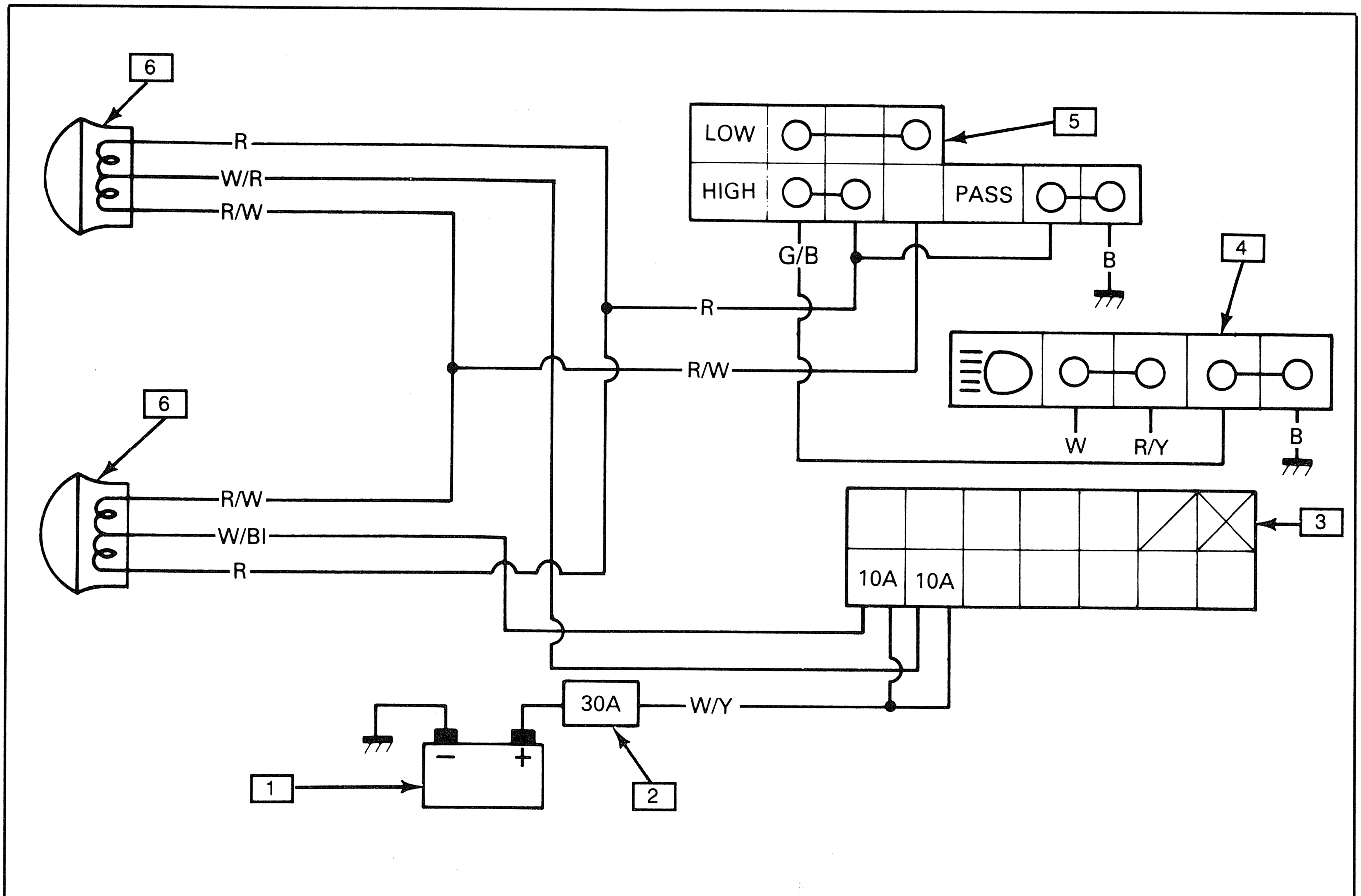
KC1427-8-M-RS

Figure 33 Instrument Panel Switches Disassembly



1	PARKING BRAKE LEVER BEZEL ATTACHING SCREW
2	PARKING BRAKE LEVER BEZEL
3	SHIFT CONTROL LEVER CONSOLE ATTACHING SCREWS
4	SHIFT CONTROL LEVER CONSOLE
5	CONSOLE BOX ATTACHING SCREWS
6	CONSOLE BOX

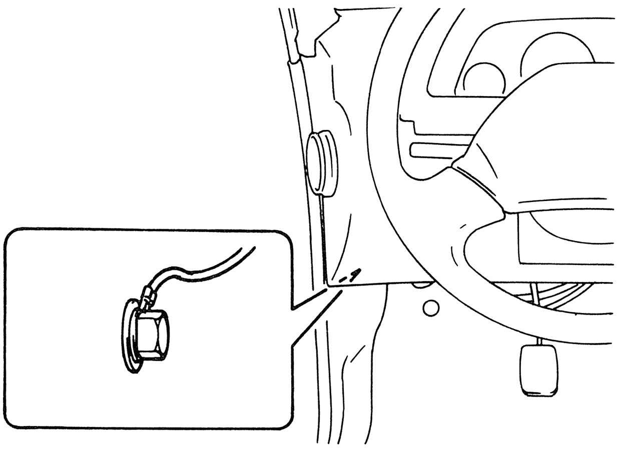
RS Figure 34 Console Exploded View


6
R
W/R
R/W
6
R/W
W/Bl
R
LOW
HIGH
PASS
5
G/B
B
R
R/W
4
W
R/Y
B
3
10A
10A
30A
W/Y
1
2
–
+

1 BATTERY
2 MAIN FUSE
3 FUSE BLOCK
4 LIGHT SWITCH
5 DIMMER SWITCH
6 HEADLAMPS

KC1372-8-M-RS

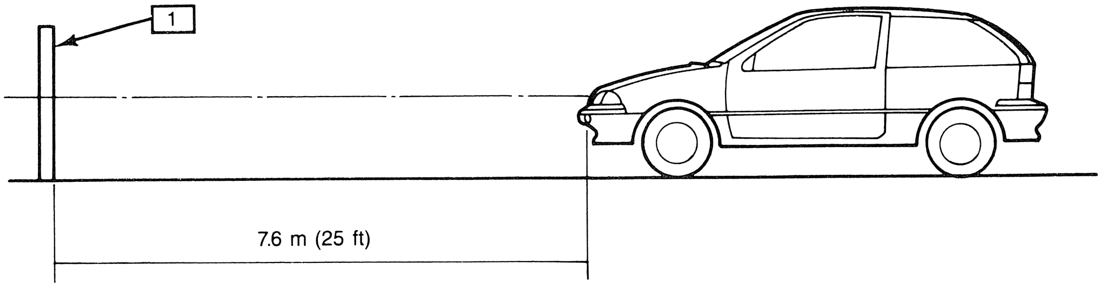
Figure 35 Headlamp Circuit



1 GROUND CONNECTION

KC1373-8-M-RS

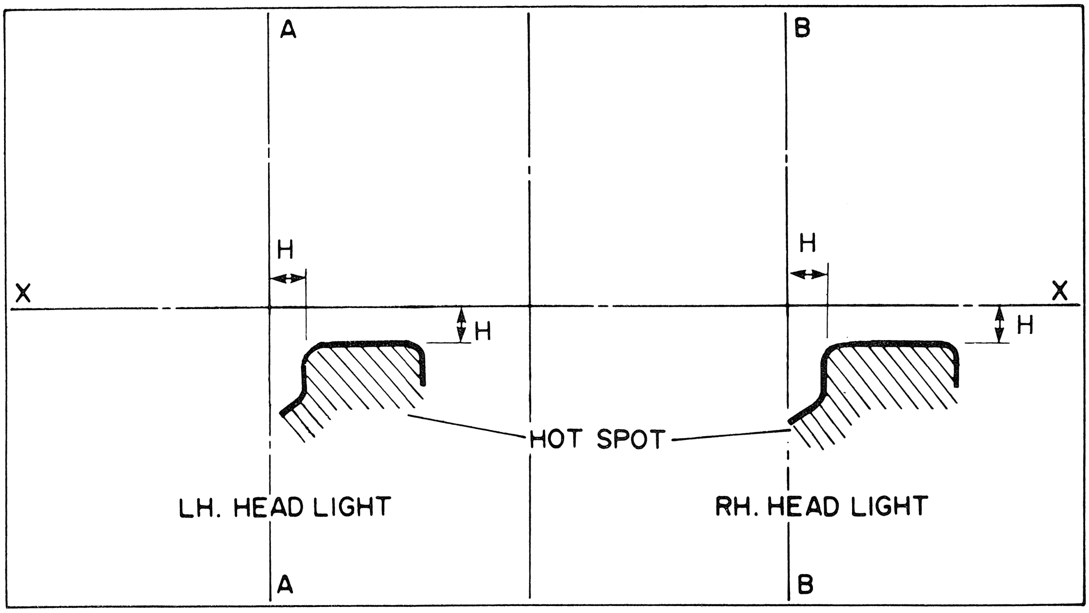
Figure 36 Headlamp Circuit Ground Locations



1 SCREEN

KC1374-8-M-RS

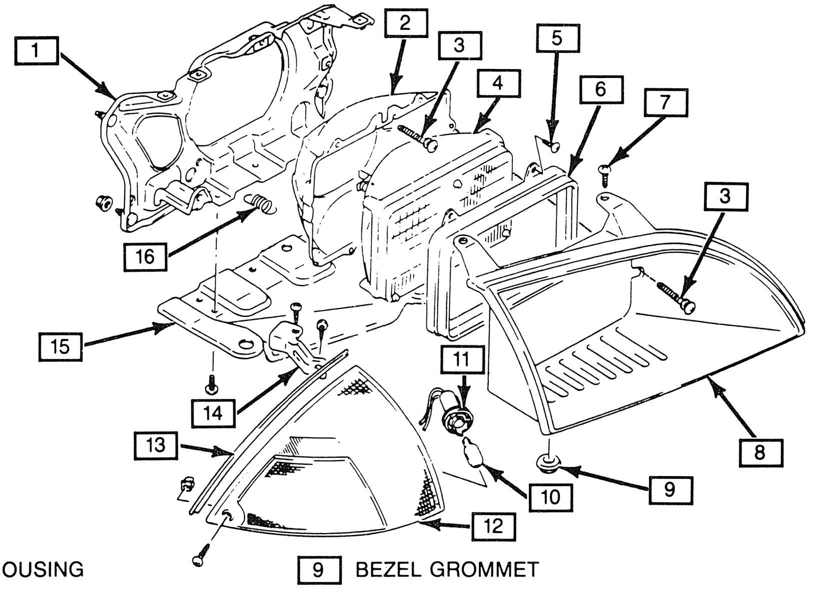
Figure 37 Headlamp Aiming


A
B
H
H
X
X
H
H
HOT SPOT
LH. HEAD LIGHT
RH. HEAD LIGHT
A
B

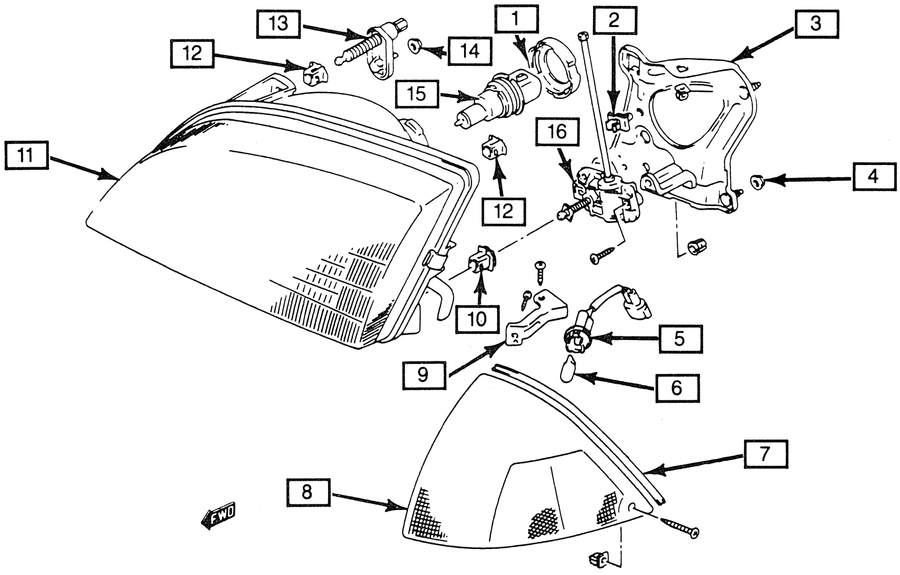
X–X: HORIZONTAL CENTER LINE OF HEADLIGHTS
A–A: VERTICAL CENTER LINE OF LEFT HEADLIGHT
B–B: VERTICAL CENTER LINE OF RIGHT HEADLIGHT
H: 25mm (0.98 in.)

KC1375-8-M-RS

Figure 38 Headlamp Adjustment Marks



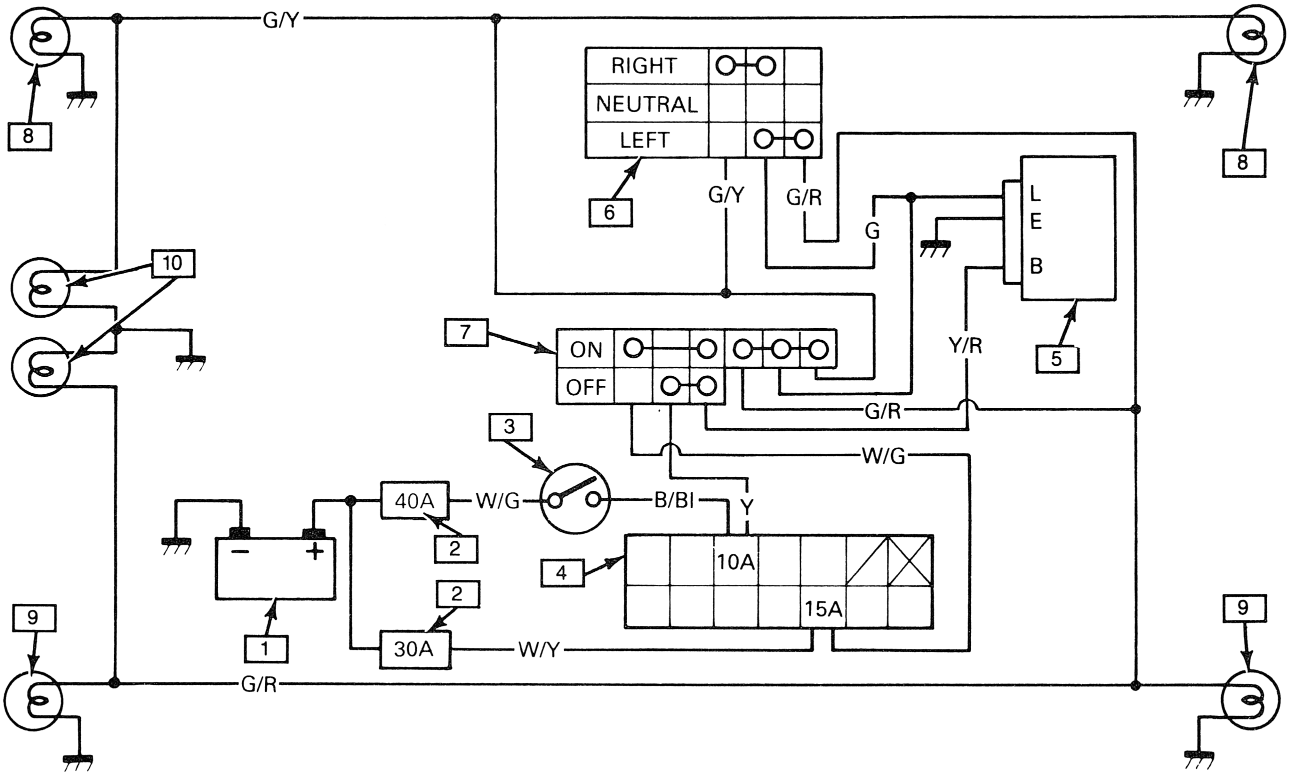
1	HEADLIGHT HOUSING
2	HEADLIGHT MOUNTING RING
3	HEADLIGHT ADJUSTING SCREW
4	HEADLIGHT SEALED BEAM (12V, 45/65W)
5	HEADLIGHT RETAINING RING SCREW
6	HEADLIGHT RETAINGING RING
7	HEADLIGHT BEZEL ATTACHING SCREW
8	HEADLIGHT BEZEL
9	BEZEL GROMMET
10	PARKING BULB (12V, 5W)
11	PARKING BULB SOCKET
12	PARKING LIGHT HOUSING
13	PARKING LIGHT HOUSING SEAT
14	PARKING LIGHT BRACKET
15	HEADLIGHT BRACKET
16	EXTENSION SPRING



1	HEADLIGHT CAPSULE BULB LOCKING CAP
2	ADJUSTING BOLT RETAINING CLIP
3	HEADLIGHT BRACKET
4	HEADLIGHT BRACKET MOUNTING NUT
5	PARKING BULB SOCKET
6	PARKING BULB (12V, 5W)
7	PARKING LIGHT HOUSING SEAL
8	PARKING LIGHT HOUSING
9	PARKING LIGHT BRACKET
10	LOWER SPHERICAL BEARING
11	HEADLIGHT CAPSULE HOUSING
12	UPPER SPHERICAL BEARING
13	ADJUSTING BOLT ASSEMBLY
14	ADJUSTING BOLT ASSEMBLY ATTACHING NUT
15	HEADLIGHT CAPSULE BULB ASSEMBLY (12V, 45/65W)
16	ADJUSTING BOLT & GEAR ASSEMBLY

KC1422-8-M-RS

Figure 39 Headlamp Exploded View


G/Y
RIGHT
NEUTRAL
LEFT
6
8
G/Y
G/R
G
L
E
B
10
7
ON
OFF
Y/R
5
3
G/R
W/G
40A
W/G
B/BI
Y
2
4
10A
15A
9
2
1
30A
W/Y
G/R
9
8

1 BATTERY
2 MAIN FUSE
3 IGNITION SWITCH
4 FUSE BLOCK
5 TURN SIGNAL RELAY
6 TURN SIGNAL SWITCH
7 HAZARD SWITCH
8 RIGHT TURN SIGNAL LAMPS
9 LEFT TURN SIGNAL LAMPS
10 TURN SIGNAL CLUSTER LIGHTS

G/R: GREEN/RED
W/Y: WHITE/YELLOW
W/G: WHITE/GREEN
B/BL: BLACK/BLUE
Y/R : YELLOW/RED
G/Y : GREEN/YELLOW
G : GREEN
Y : YELLOW

KC1377-8-M-RS

Figure 40 Turn Signal Hazard Warning Circuit

DIAGNOSIS

Condition	Possible Cause	Correction
One light only does not light	Lamp burnt out.	Replace lamp.
	Fuse blown.	Replace fuse.
	Faulty socket, wiring or grounding.	Repair as necessary.
Headlamps do not light	Fuse blown.	Replace fuse and check.
	Light/Hazard flasher or Turn Signal/Dimmer switch faulty.	Check switches.
	Faulty wiring or grounding.	Repair as necessary.

CONDITION	POSSIBLE CAUSE	CORRECTION
One beam (HI or LO) only does not light	Light/Hazard flasher or Turn Signal/Dimmer switch faulty.	Check switch.

Inspect

1. Check the Light/Hazard flasher and Turn Signal/Dimmer switches for each terminal-to-terminal continuity (See section "SWITCHES").
2. The headlamps are grounded below the left and right dash side panels, and at the junction/fuseblock (Figure 36).

ADJUSTING HEADLAMP BEAMS (STANDARD PROCEDURE)

Before adjusting the headlamp beams, adjust air pressures of all tires to the specified value. Move the vehicle up and down by hand to settle its suspension. Then move it over a flat surface. There are available a variety of headlamp beams setting methods (e.g., the screen method using a focusing tester, etc.). However, the method described here does not use such a tester.

1. Beam Alignment

   Unless otherwise required by local regulations, align the headlamp beams according to the following procedure:

   - Place a vehicle 7.6m (25 ft.) from a blank wall. Check to see if the hot spot (high intensity zone) of each main (high) beam axis falls as illustrated. The beam alignment should be carried out with a driver (68kg, 150 kg, 150 lb.) aboard. (Figures 37 and 38).

2. Headlamp Adjustment

   There are two screws which can be used for adjustment. Use these screws to adjust the headlamp position for the vertical and horizontal alignment of each beam (Figure 39).

TURN SIGNAL AND HAZARD WARNING LIGHTS

WIRING CIRCUIT

Inspect (Figures 40 and 41)

1. Check turn signal/dimmer switch and light/hazard flasher for each terminal-to-terminal continuity (See section "SWITCHES") (Figure 40).
2. Turn signal bulbs should be grounded at each side of front fender apron (Figure 41).

DIAGNOSIS

CONDITION	POSSIBLE CAUSE	CORRECTION
Flash rate high or one side only flashes.	Faulty ground.	Repair.
	Wrong Bulb.	Replace.
	One of the light bulbs burnt out on the right or left side of the front or rear of the vehicle.	Replace.
	Defective flasher (turn and hazard).	Replace.
	Open circuit or high resistance existing between the turn signal/dimmer switch and/or light/hazard flasher switch and the lights on one side.	Repair.
No flashing.	Blown fuse on turn signal-and-hazard warning circuit.	Replace.
	Open circuit or high resistance existing between battery and switch.	Repair.
	Open circuit or high resistance existing between switch and relay.	Repair.
	Defective switch.	Replace.
	Defective relay.	Replace.
Flash rate low.	Supply voltage too low.	Recharge battery.
	Defective relay.	Replace.

LC0002-8-M-RS

BACKUP LAMPS

WIRING CIRCUIT

For repair and diagnosis use the following wiring diagrams (Figures 42 and 43).

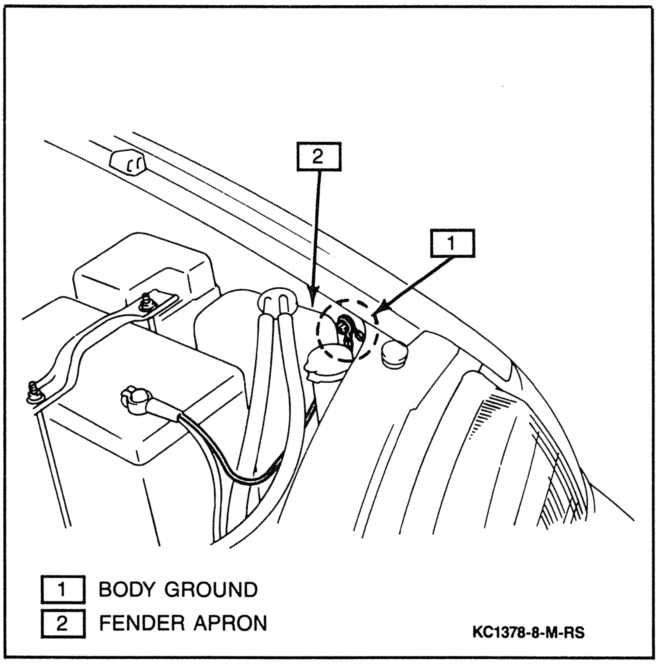

2
1
1 BODY GROUND
2 FENDER APRON
KC1378-8-M-RS

Figure 41 Turn Signal Ground Connection

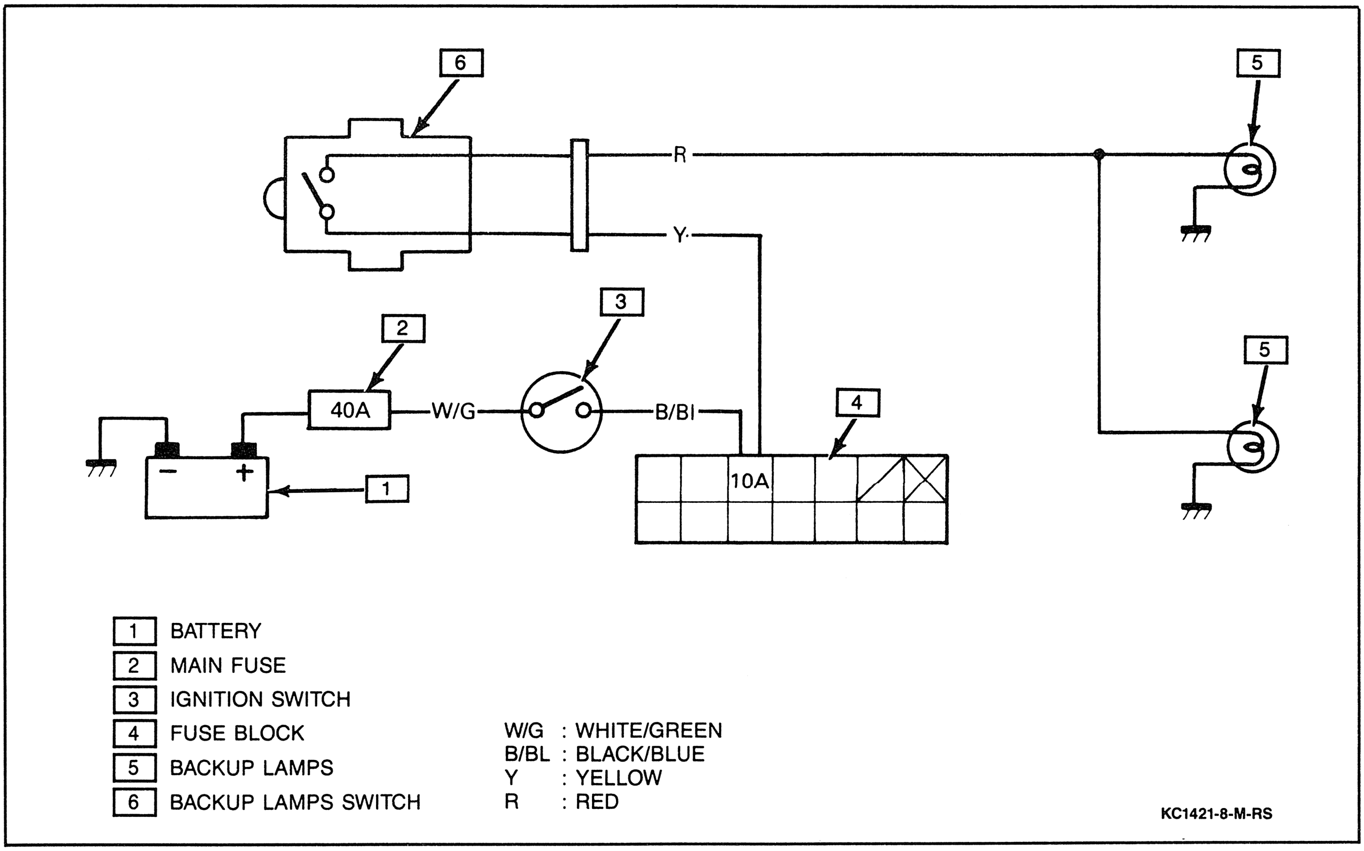

6
5
R
Y
3
2
5
40A
W/G
B/Bl
4
10A
1
1 BATTERY
2 MAIN FUSE
3 IGNITION SWITCH
4 FUSE BLOCK
5 BACKUP LAMPS
6 BACKUP LAMPS SWITCH
W/G : WHITE/GREEN
B/BL : BLACK/BLUE
Y : YELLOW
R : RED
KC1421-8-M-RS

Figure 42 Backup Lamp Circuit (Manual Transaxle Only)

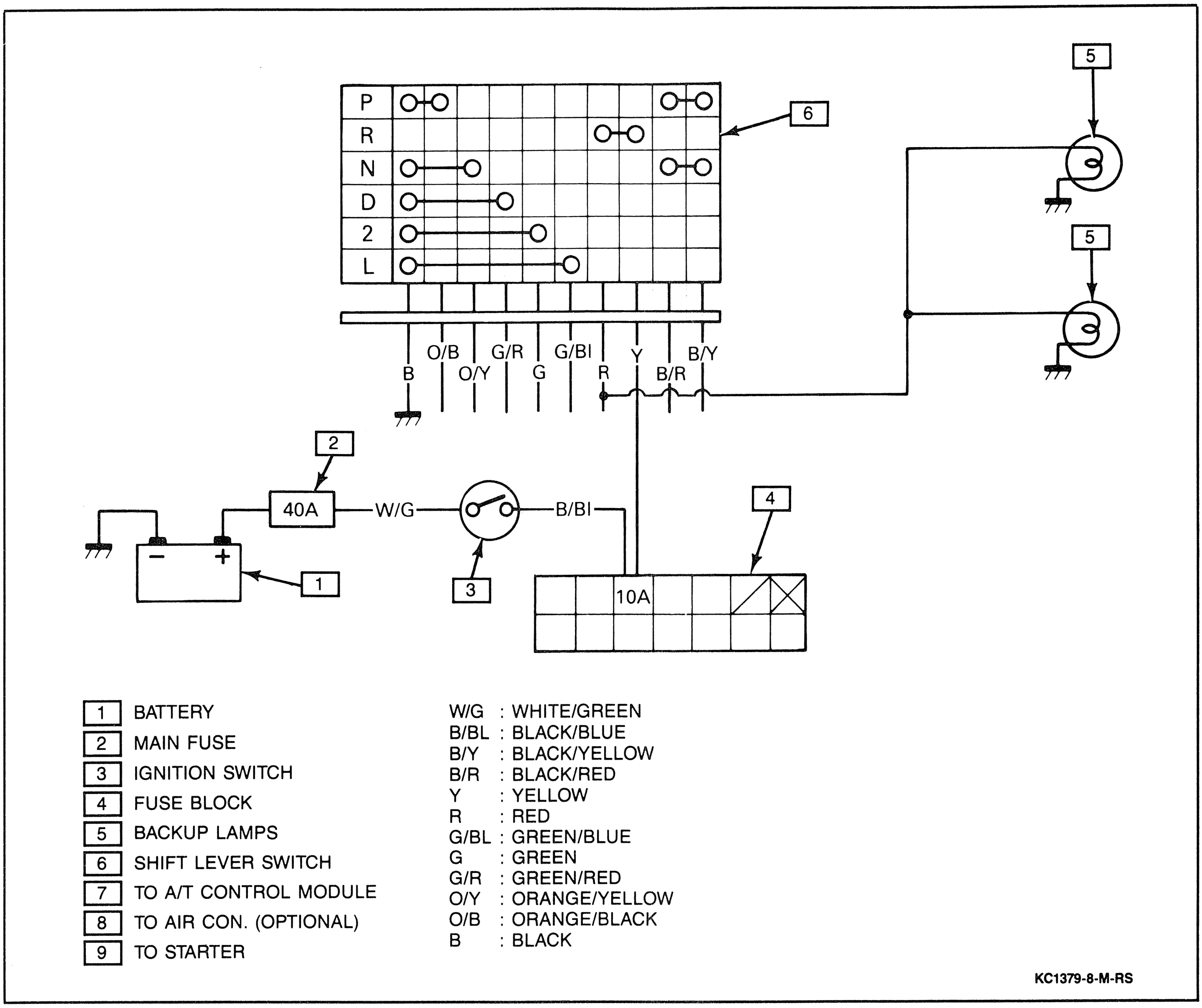

P
R
N
D
2
L
6
5
5
O/B
G/R
G/Bl
Y
B/Y
B
O/Y
G
R
B/R
2
40A
W/G
B/Bl
4
1
3
10A
1 BATTERY
2 MAIN FUSE
3 IGNITION SWITCH
4 FUSE BLOCK
5 BACKUP LAMPS
6 SHIFT LEVER SWITCH
7 TO A/T CONTROL MODULE
8 TO AIR CON. (OPTIONAL)
9 TO STARTER
W/G : WHITE/GREEN
B/BL : BLACK/BLUE
B/Y : BLACK/YELLOW
B/R : BLACK/RED
Y : YELLOW
R : RED
G/BL : GREEN/BLUE
G : GREEN
G/R : GREEN/RED
O/Y : ORANGE/YELLOW
O/B : ORANGE/BLACK
B : BLACK
KC1379-8-M-RS

Figure 43 Backup Lamp Circuit (Automatic Transaxle Only)

DIAGNOSIS

Condition	Possible Cause	Correction
Backup lamps do not light	Fuse blown.	Replace fuse, check for short.
	Backup lamp switch faulty.	Check switch.
	Wiring or grounding faulty.	Repair as necessary.

STOPLAMPS

WIRING CIRCUIT

Inspect (Figure 44)

1. Check the stoplamp switch for each terminal-to-terminal continuity (See section "SWITCHES") (Figure 44).
2. For stoplamp ground locations see section 10-11.

PARK, TAIL, SIDE MARKER LAMPS, AND LICENSE LAMP

WIRING CIRCUIT

For repair and diagnosis use the following wiring diagram (Figure 45).

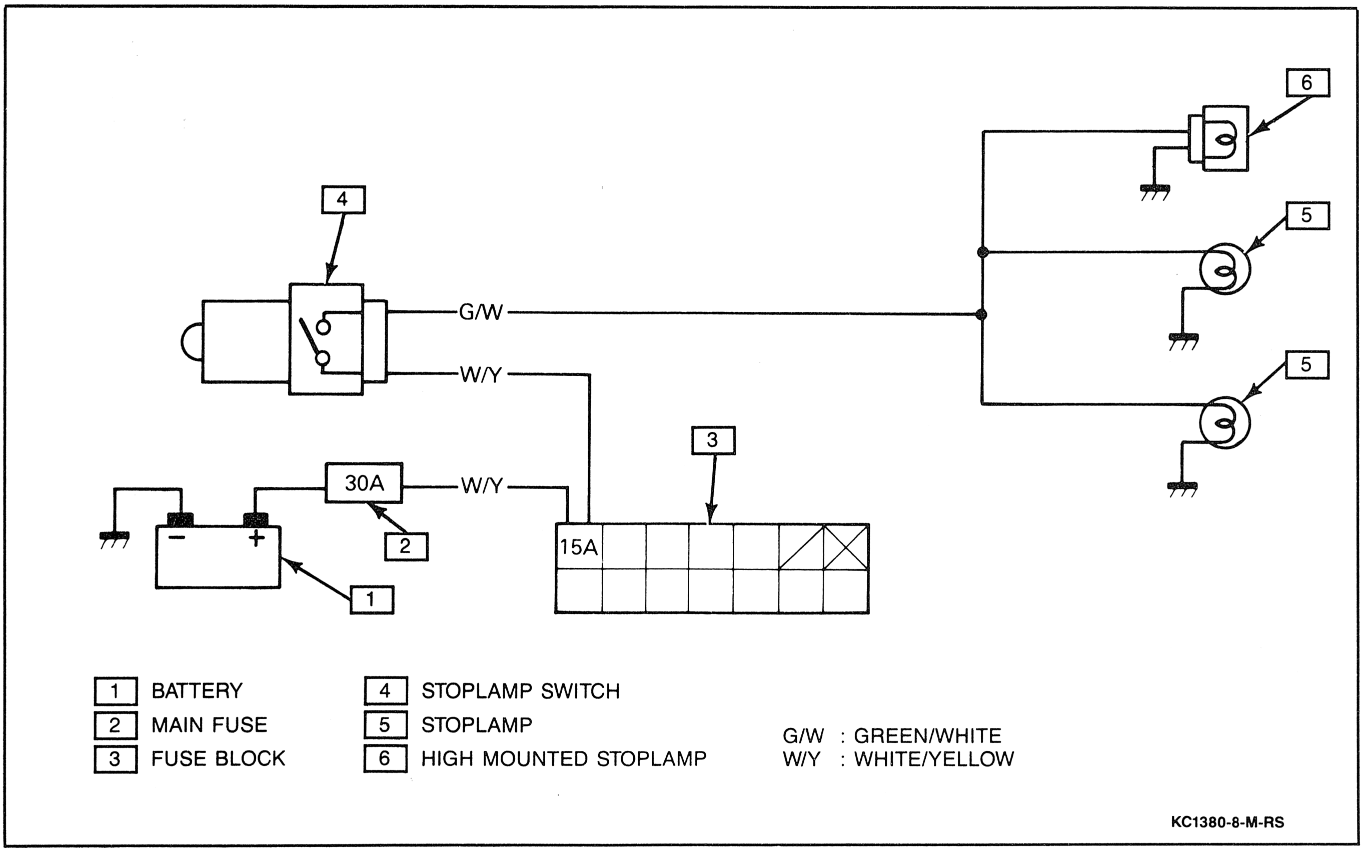

6
4
5
G/W
W/Y
5
3
30A
W/Y
15A
2
1
1 BATTERY
2 MAIN FUSE
3 FUSE BLOCK
4 STOPLAMP SWITCH
5 STOPLAMP
6 HIGH MOUNTED STOPLAMP
G/W : GREEN/WHITE
W/Y : WHITE/YELLOW
KC1380-8-M-RS

Figure 44 Stoplamp Circuit

DIAGNOSIS

Condition	Possible Cause	Correction
Stoplamps do not light	Fuse blown.	Replace fuse and check for short.
	Stoplamp switch faulty.	Adjust or replace switch.
	Wiring or grounding faulty.	Repair as necessary.
Stoplamps stays on.	Stoplamp switch faulty.	Adjust or replace switch.

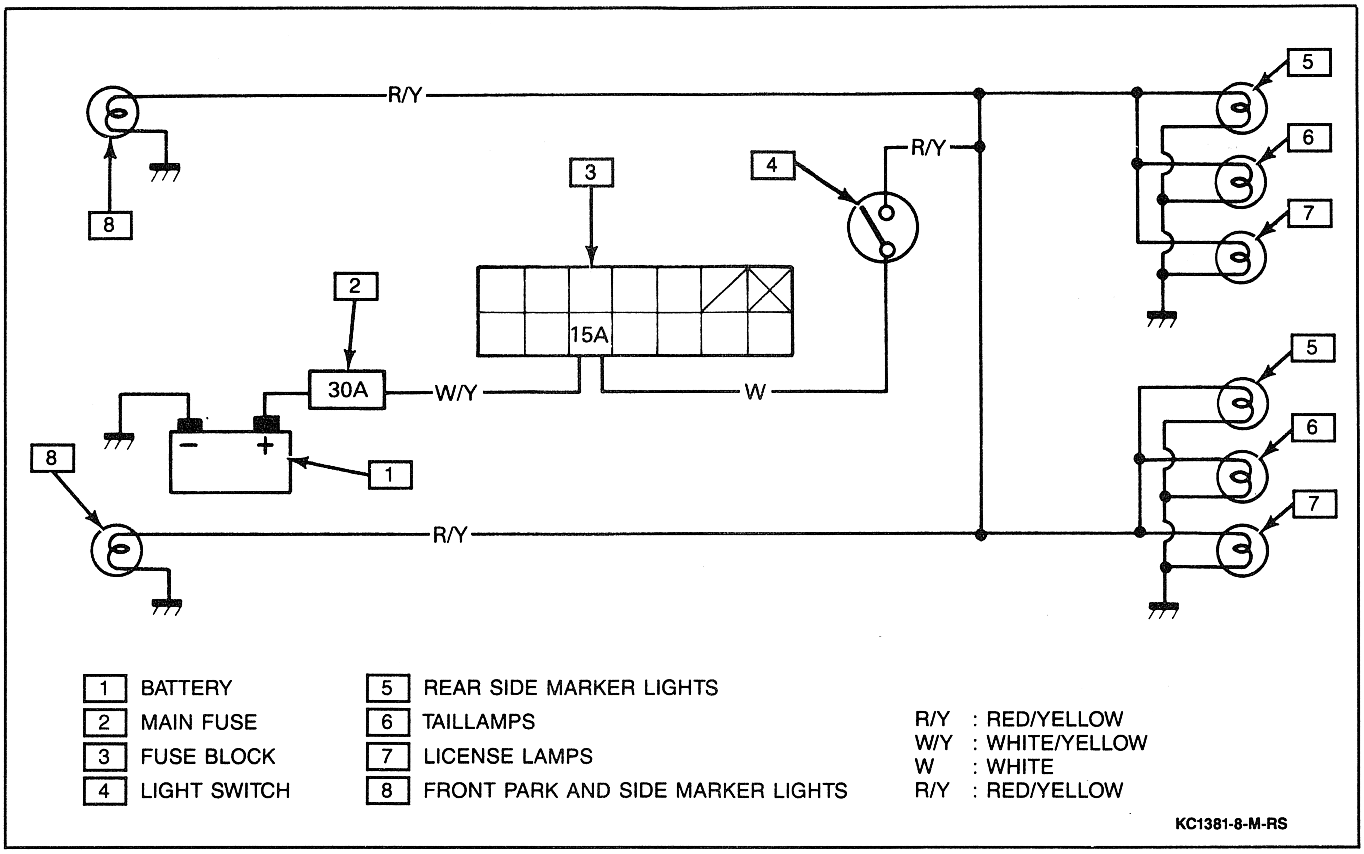

R/Y
R/Y
R/Y
W/Y
W
30A
15A
1
2
3
4
5
6
7
8
1 BATTERY
2 MAIN FUSE
3 FUSE BLOCK
4 LIGHT SWITCH
5 REAR SIDE MARKER LIGHTS
6 TAILLAMPS
7 LICENSE LAMPS
8 FRONT PARK AND SIDE MARKER LIGHTS
R/Y : RED/YELLOW
W/Y : WHITE/YELLOW
W : WHITE
R/Y : RED/YELLOW
KC1381-8-M-RS

Figure 45 Rear Lighting Circuit

DIAGNOSIS

Condition	Possible Cause	Correction
Lamps and Lamp do not light	Main fuse and/ or fuses blown.	Replace main fuse and/or fuses to check for short.
	Light/hazard switch faulty.	Check switch.
	Wiring or grounding faulty.	Repair as necessary.

INTERIOR (DOME) LAMP

WIRING CIRCUIT

For repair and diagnosis use the following wiring diagram (Figure 46).

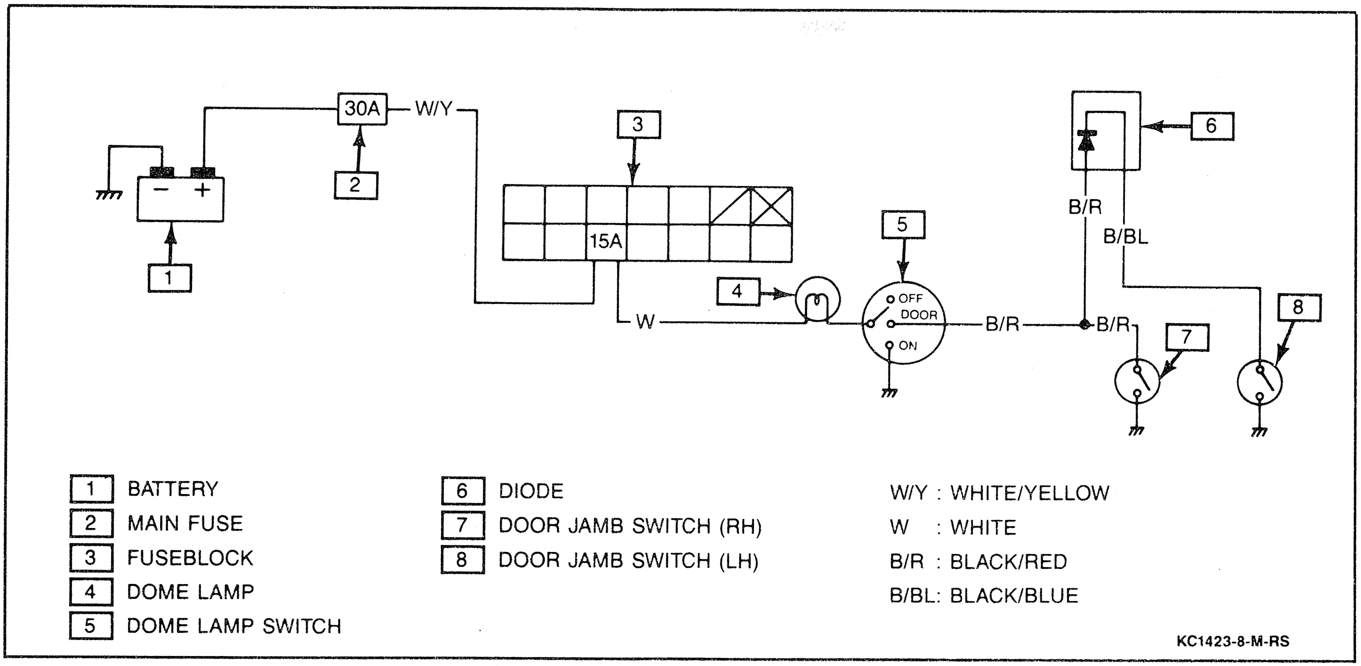

30A
W/Y
2
1
3
15A
W
4
5
OFF
DOOR
ON
B/R
B/R
B/R
B/BL
6
7
8
1 BATTERY
2 MAIN FUSE
3 FUSEBLOCK
4 DOME LAMP
5 DOME LAMP SWITCH
6 DIODE
7 DOOR JAMB SWITCH (RH)
8 DOOR JAMB SWITCH (LH)
W/Y : WHITE/YELLOW
W : WHITE
B/R : BLACK/RED
B/BL: BLACK/BLUE
KC1423-8-M-RS

Figure 46 Interior Lamp Circuit

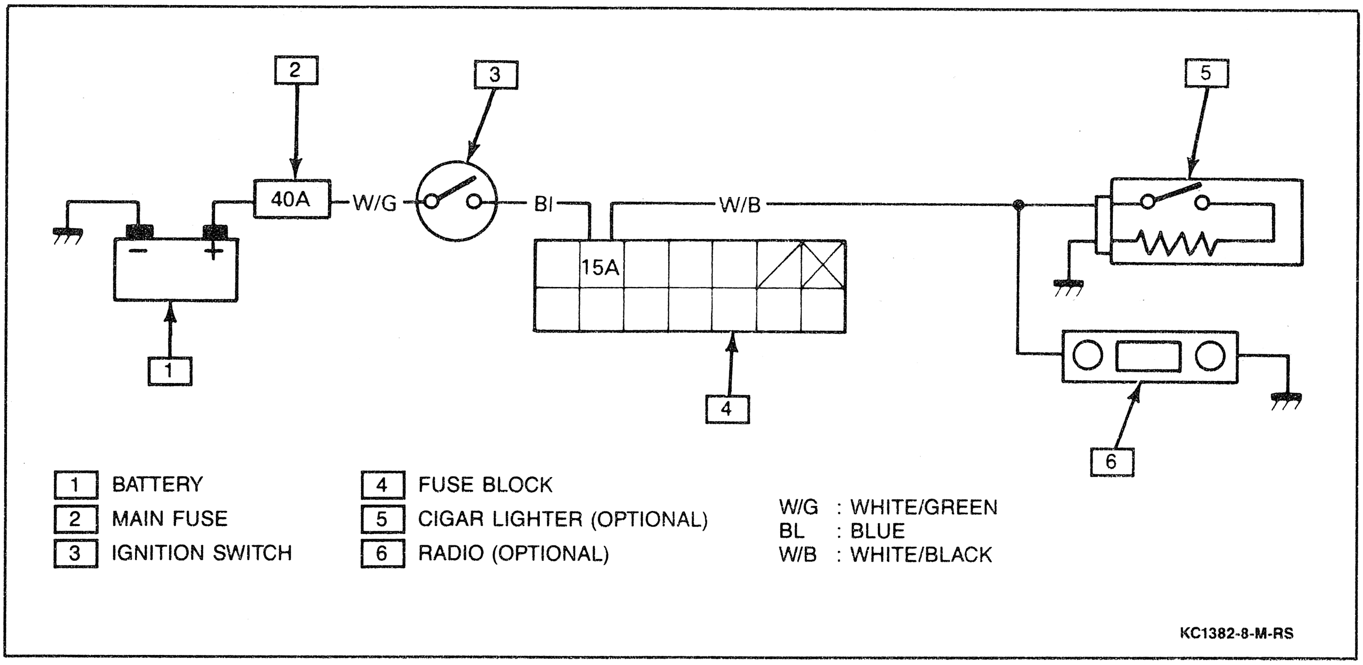

2
3
5
40A
W/G
BI
W/B
15A
1
4
6
1 BATTERY
2 MAIN FUSE
3 IGNITION SWITCH
4 FUSE BLOCK
5 CIGAR LIGHTER (OPTIONAL)
6 RADIO (OPTIONAL)
W/G : WHITE/GREEN
BL : BLUE
W/B : WHITE/BLACK
KC1382-8-M-RS

Figure 47 Optional Circuit Wiring

DIAGNOSIS

Condition	Possible Cause	Correction
Dome lamp does not light	Fuse blown.	Replace fuse and check for short.
	Jamb switch is faulty.	Check switch(es).
	Wiring or grounding faulty.	Repair as necessary.

CIGAR LIGHTER AND RADIO

WIRING CIRCUIT

For repair and diagnosis use the following wiring diagram (Figure 47).

DIAGNOSIS

Condition	Possible cause	Correction
Cigar lighter (radio) does not work	Fuse blown.	Replace fuse and check for short.
	Ignition switch faulty.	Check switch.
	Wiring or grounding faulty.	Repair as necessary.

ON-VEHICLE SERVICE

LICENSE LAMP, BACKUP, TAIL, AND SIDE MARKER LAMP BULBS

←→ **Remove or Disconnect**

1. Negative battery cable.
2. Two rear combination lamp assembly mounting screws.
3. Rear combination lamp assembly from vehicle.
4. Lamp socket from rear combination lamp housing by turning counterclockwise.
5. Bulb from socket by turning counterclockwise.

→← **Install or Connect**

1. Bulb to socket by turning clockwise.
2. Lamp socket to rear combination lamp housing by turning clockwise.
3. Rear combination lamp assembly to vehicle.
4. Two rear conbination lamp assembly mounting screws.
5. Negative battery cable.

HIGH-MOUNTED STOPLAMP BULB

←→ **Remove or Disconnect**

1. Negative battery cable.
2. Two attaching screws from high-mounted stoplamp housing and separate housing.
3. Bulb from socket by pulling straight out.

→← **Install or Connect**

1. Bulb to socket by pushing straight in.
2. High-mounted stoplamp housing and two attaching screws.
3. Negative battery cable.

FRONT PARK AND SIDE MARKER LAMP BULB AND ASSEMBLY

←→ **Remove or Disconnect**

1. Negative battery cable.
2. Two parking lamp housing mounting screws and housing from the vehicle.
3. Socket from parking lamp housing by turning counterclockwise.
4. Bulb from socket by pulling straight out.

→← **Install or Connect**

1. Bulb to socket by pushing straight in.
2. Socket to parking lamp housing by turning clockwise.
3. Housing to vehicle and two parking light housing mounting screws.
4. Negative battery cable.

REAR COMBINATION LAMP ASSEMBLY

←→ **Remove or Disconnect**

1. Negative battery cable.
2. Nine push pins from the rear pillar access panel.
3. Panel from vehicle.
4. Rear combination lamp assembly electrical connector.
5. Two rear combination lamp assembly mounting screws.
6. Assembly from vehicle by removing wire harness from the rear pillar.

→← **Install or Connect**

1. Assembly to vehicle by installing wire harness.

2 Two rear combination lamp assembly mounting screws.

3. Rear combination lamp assembly electrical connector.
4. Panel to vehicle.
5. Nine push pins to the rear pillar access panel.
6. Negative battery cable.

HIGH-MOUNTED STOPLAMP ASSEMBLY

Remove or Disconnect

1. Negative battery cable.
2. Right and left hand rear radio speakers, if equipped (See section 9A).
3. Nine push pins from the rear lid access panel.
4. Panel from vehicle.
5. High-mounted stoplamp electrical connector.
6. Two high-mounted stoplamp assembly mounting screws.
7. Assembly from vehicle.

Install or Connect

1. Assembly to vehicle.
2. Two high-mounted stoplamp assembly mounting screws.
3. Panel to vehicle.
4. Nine push pins to the rear lid access panel.
5. Right and left hand rear radio speakers, if equipped (See section 9A).
6. Negative battery cable.

FRONT TURN SIGNAL LAMP BULB AND ASSEMBLY

Remove or Disconnect

1. Negative battery cable.
2. Two turn signal lamp housing screws.
3. Turn signal lamp lens from housing.
4. Turn signal bulb from housing by turning counterclockwise.
5. Turn signal lamp electrical connector.
6. Housing from vehicle.

Install or Connect

1. Housing to vehicle.
2. Turn signal lamp electrical connector.
3. Turn signal bulb to housing by turning clockwise.
4. Turn signal lamp lens to housing.
5. Two turn signal lamp housing screws.
6. Negative battery cable.

HEADLAMP SEALED BEAM

Remove or Disconnect (Figure 39)

1. Negative battery cable.
2. Two bezel attaching screws and bezel from vehicle.
3. Headlamp electrical connector at rear of headlamp sealed beam.
4. Four headlamp retaining ring screws.
5. Retaining ring from mounting ring.
6. Headlamp sealed beam from mounting ring.

Install or Connect

1. Headlamp sealed beam to mounting ring.
2. Retaining ring to mounting ring.
3. Four headlamp retaining ring screws.
4. Headlamp electrical connector at rear of headlamp sealed beam.
5. Bezel to vehicle and two attaching bezel attaching screws.
6. Negative battery cable.

HEADLAMP CAPSULE BULB AND HOUSING - LSI

Remove or Disconnect (Figure 39)

1. Negative battery cable.
2. Capsule bulb locking cap.
3. Capsule bulb assembly from capsule housing.
4. Capsule bulb from assembly by pulling straight out.
5. Parking light assembly (See procedure in this section).
6. Windshield washer fluid reservoir and pump as an assembly (See procedure in this section).

NOTICE: Step 6 of this procedure is used only to remove the left hand headlamp capsule housing.

7. Three lower push pins and one attaching screw from the right hand fender skirt, and push skirt back away from fender.
8. Two mounting nuts from the intake air baffle.
9. Baffle, to gain access to the headlamp bracket.

NOTICE: Steps 7, 8, and 9 of this procedure are used only to remove the right hand headlamp capsule housing.

10. Two mounting nuts from the headlamp bracket.
11. One adjuster bolt assembly attaching nut from the assembly.
12. Headlamp capsule assembly.
13. Upper and lower spherical bearings from the headlamp capsule housing.

Install or Connect

1. Upper and lower spherical bearings to the headlamp capsule housing.
2. Headlamp capsule assembly.
3. One adjuster bolt assembly attaching nut to the assembly.
4. Two mounting nuts to the headlamp bracket.
5. Baffle.
6. Two mounting nuts to the intake air baffle.
7. Three lower push pins and one attaching screw to the right hand fender skirt.
8. Windshield washer fluid reservoir and pump as an assembly (See procedure in this section).

9. Parking lamp assembly (See procedure in this section).
10. Capsule bulb to assembly.
11. Negative battery cable.

FRONT WINDSHIELD WIPERS AND WASHERS

The windshield wipers are of the two or three speed (intermittent) type. The windshield washers are equipped with a separate type washer pump. The windshield washer fluid reservoir is located near the front of the left front fender. There are washer pumps for the front and rear (optional) wiper systems.

DESCRIPTION OF CIRCUIT

The circuit is designed so that when the wiper switch is turned OFF the wiper blades automatically return to their specified level park positions. When the wiper switch is turned ON with the ignition switch ON, current is supplied continuously from the battery (via lead Y/Bl - switch - lead Bl or Bl/R) to the motor, rotating the motor to move the blades (Figure 49).

The gear-and-linkage mechanism, which converts the rotary movement of the motor to the wiping movement of the blades, has a cam on the shaft of its output gear.

The cam serves to connect contact P_0 to the contact P_1. Although the cam thus serves to make and break the circuits containing the contacts P_0, P_1, and P_2, the wiper motor makes its rotation completely independent of this cam rotation. When the wiper switch is turned OFF (the switch is set to the OFF position) with the blades positioned at the park positions, current supply is cut, causing the motor to stop with the blades staying in the same positions.

Even when the wiper switch if turned OFF (the switch is set to the OFF position) with the blades positioned other than at the park positions, current is still supplied, though intermittently, through a different path from the battery (via lead Y/Bl - contact P_2 - contact P_0 - lead Bl/W - switch (OFF position) - lead Bl or Bl/R) to the motor.

Therefore, the motor can still rotate supplied with this intermittent current, causing the blades to return to the park positions.

As soon as the blades have returned to their park positions, the cam connects contact P_0 to contact P_1, causing current to be shunted around the motor.

When current is no longer supplied to the motor, a counter electromotive force is generated in the motor armature, causing a current to flow through the motor-and-shunt circuit so that the motor is stopped with the blades staying at the specified level park positions.

3-Speed (Intermittent) Wiper Relay Circuit (Front Wiper)

When the wiper switch is set to the intermittent position with the ignition switch ON (the condenser is charged at this time), current from the battery flows through the Y/Bl wire, generates magnetic force in the coil in the relay and causes the contacts in the relay to close. Then current is transmitted in the sequence of Y/Bl, Bl/W, wiper switch, and Bl causing the wiper motor to rotate (meanwhile, the condenser discharges). By the time the wiper motor makes one rotation and the cam in the motor comes to the park position P_1 the condenser in the relay has finished discharging (no magnetic force in the coil in the relay). Then the contacts in the relay open and the wiper arm stop in the park position. They remain that way until the condenser is fully charged. As soon as the condenser begins discharging after being fully charged, magnetic force generated in the the relay causes the contacts to close. As described above, intermittent operation of the wiper motor is controlled by charging and discharging of the condenser (Figure 49).

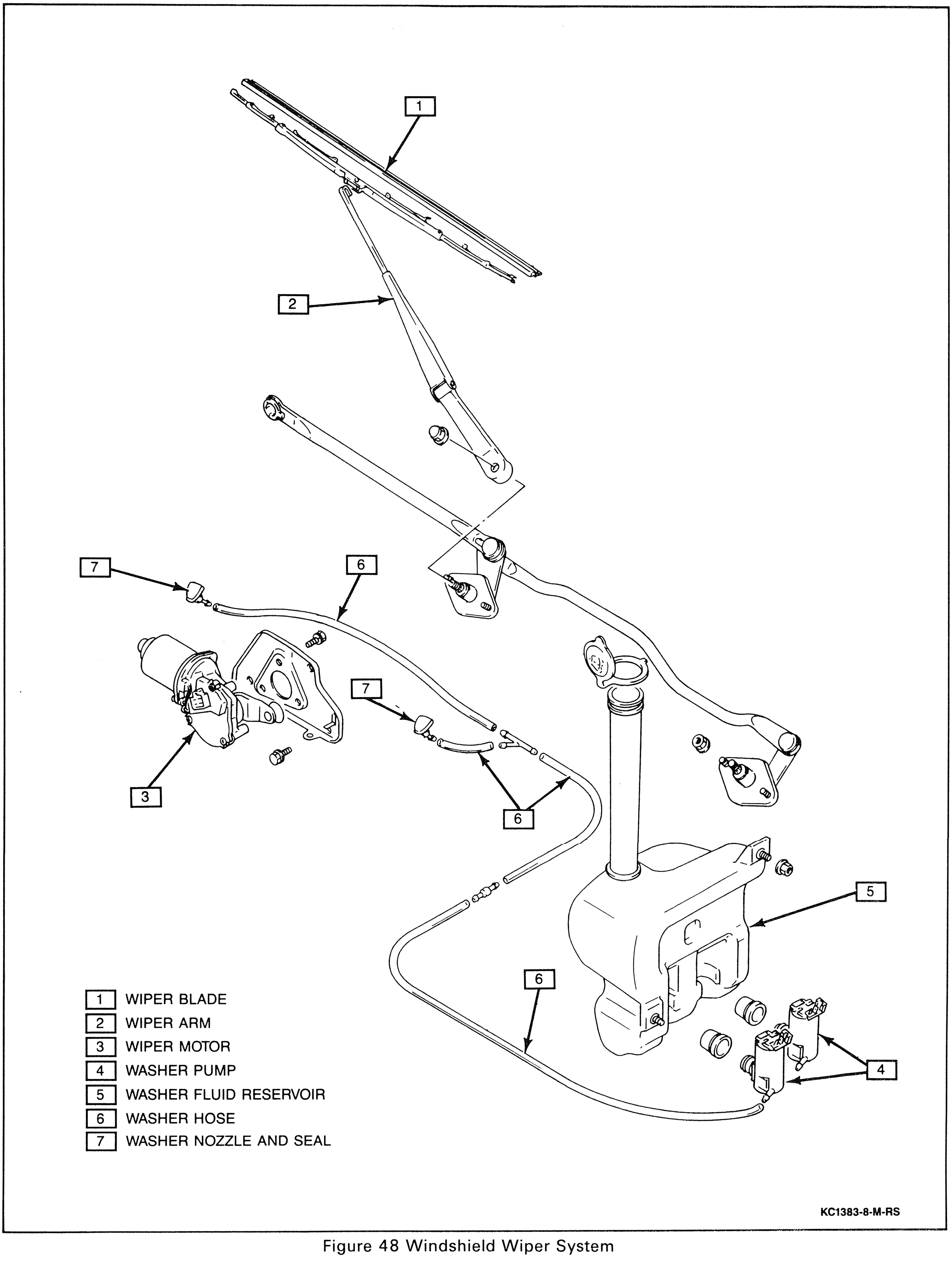
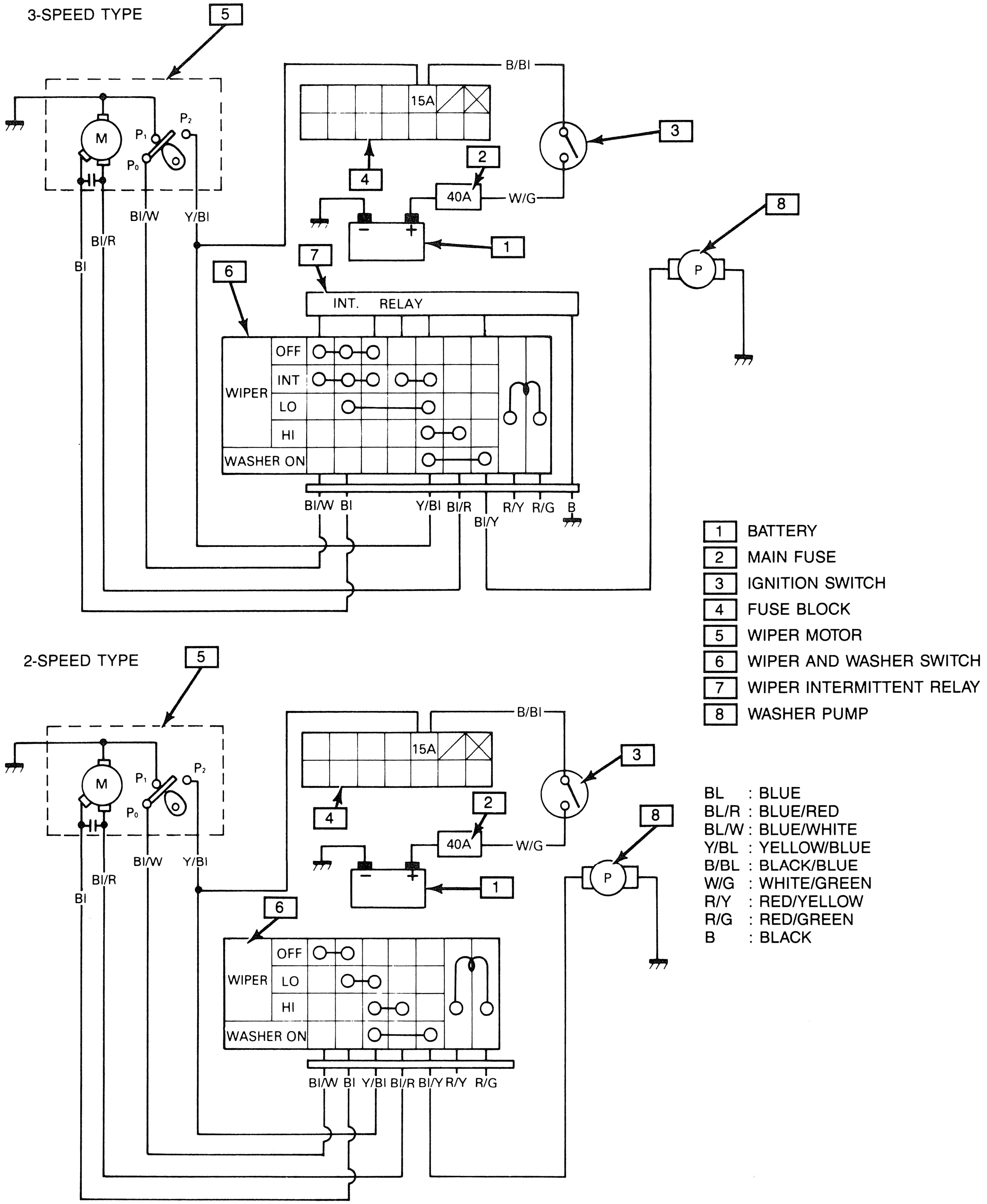

1
2
7
6
7
3
6
5
6
4
1 WIPER BLADE
2 WIPER ARM
3 WIPER MOTOR
4 WASHER PUMP
5 WASHER FLUID RESERVOIR
6 WASHER HOSE
7 WASHER NOZZLE AND SEAL
KC1383-8-M-RS

Figure 48 Windshield Wiper System


3-SPEED TYPE
5
3
8
6
7
4
2
1
M
P1
P2
P0
B/Bl
15A
40A
W/G
Bl/W
Y/Bl
Bl/R
Bl
INT. RELAY
WIPER
OFF
INT
LO
HI
WASHER ON
P
Bl/W Bl Y/Bl Bl/R Bl/Y R/Y R/G B
2-SPEED TYPE
Bl/W Bl Y/Bl Bl/R Bl/Y R/Y R/G
KC1384-8-M-RS

1	BATTERY
2	MAIN FUSE
3	IGNITION SWITCH
4	FUSE BLOCK
5	WIPER MOTOR
6	WIPER AND WASHER SWITCH
7	WIPER INTERMITTENT RELAY
8	WASHER PUMP

BL	BLUE
BL/R	BLUE/RED
BL/W	BLUE/WHITE
Y/BL	YELLOW/BLUE
B/BL	BLACK/BLUE
W/G	WHITE/GREEN
R/Y	RED/YELLOW
R/G	RED/GREEN
B	BLACK

Figure 49 Windshield Wiper Circuit

DIAGNOSIS

Condition	Possible Cause	Correction
Wiper malfunctions or does not return to original position	Wiper fuse blown.	Replace blown fuse and check for short.
	Wiper motor faulty.	Check motor.
	Wiper/washer faulty.	Check switch.
	Wiring or grounding faulty.	Repair.
Washer malfunctions	Washer hose or nozzle clogged.	Repair.
	Washer pump motor faulty.	Check motor.
	Wiper/washer switch faulty.	Check switch.
	Wiring or grounding faulty.	Repair.

WIPER/WASHER SWITCH

Use a circuit tester to check the switch for each terminal-to-terminal continuity (Figure 50).

WIPER MOTOR

Use a 12V battery to connect the motor's (+) terminal to the Blue terminal, and its (-) terminal to the Black lead wire. If the motor rotates at a low speed of 45 to 55 rpm, it is working properly. For the high speed check, connect the battery (+) terminal to the

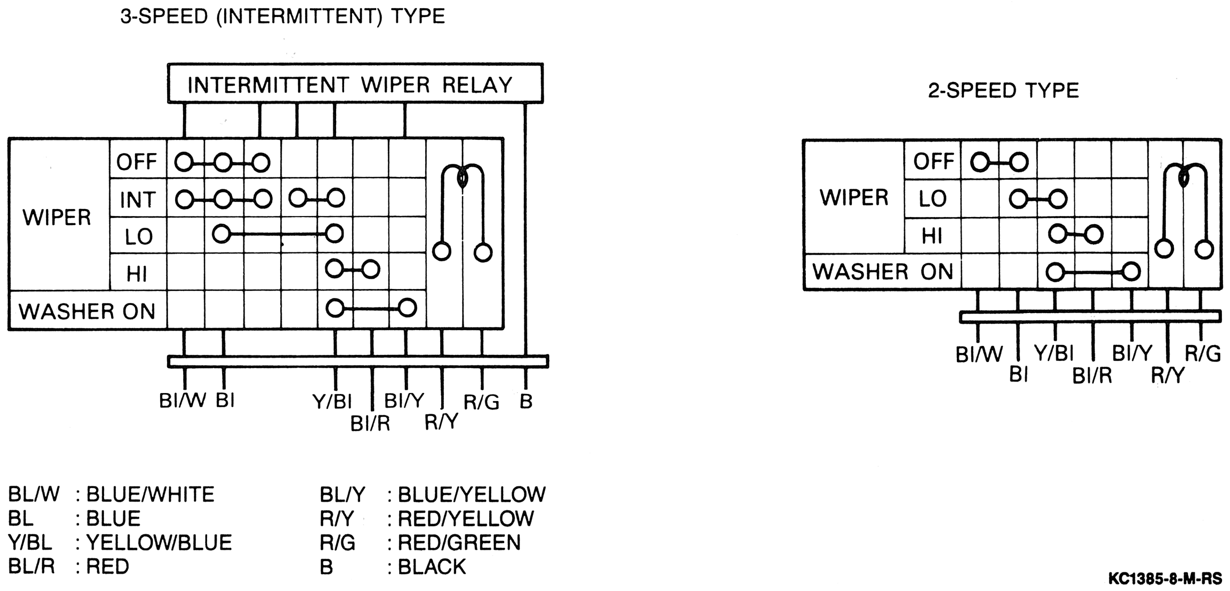

3-SPEED (INTERMITTENT) TYPE
INTERMITTENT WIPER RELAY
WIPER
OFF
INT
LO
HI
WASHER ON
Bl/W
Bl
Y/Bl
Bl/R
Bl/Y
R/Y
R/G
B
2-SPEED TYPE
WIPER
OFF
LO
HI
WASHER ON
Bl/W
Bl
Y/Bl
Bl/R
Bl/Y
R/Y
R/G
BL/W : BLUE/WHITE
BL : BLUE
Y/BL : YELLOW/BLUE
BL/R : RED
BL/Y : BLUE/YELLOW
R/Y : RED/YELLOW
R/G : RED/GREEN
B : BLACK
KC1385-8-M-RS

Figure 50 Switch Connections

Blue/Red terminal, and the (-) terminal to the Black lead wire. If the motor rotates at a high speed of 68 to 78 rpm, it is operating properly (Figure 51).

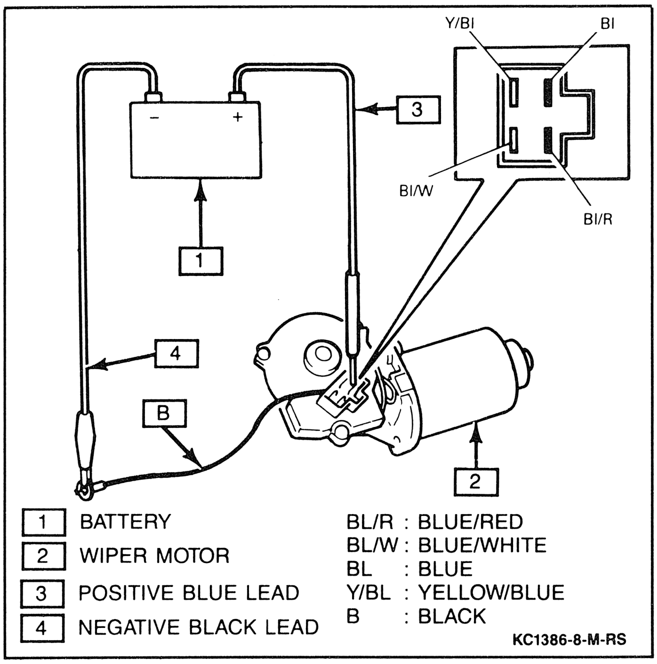

Y/Bl
Bl
3
Bl/W
Bl/R
1
4
B
2
1 BATTERY
2 WIPER MOTOR
3 POSITIVE BLUE LEAD
4 NEGATIVE BLACK LEAD
BL/R : BLUE/RED
BL/W : BLUE/WHITE
BL : BLUE
Y/BL : YELLOW/BLUE
B : BLACK
KC1386-8-M-RS

Figure 51 Wiper Motor Test

Testing Park Operation

Connect the battery (+) terminal to the motor Yellow/Blue terminal, and the (-) terminal to the Black lead wire respectively. Use a jumper to short the Blue/White and Blue terminals to each other to check whether the motor shaft stops at a given position. This position must conform to the start position. Stop the motor again and again with the jumper to confirm that it stops at the same position (Figure 52).

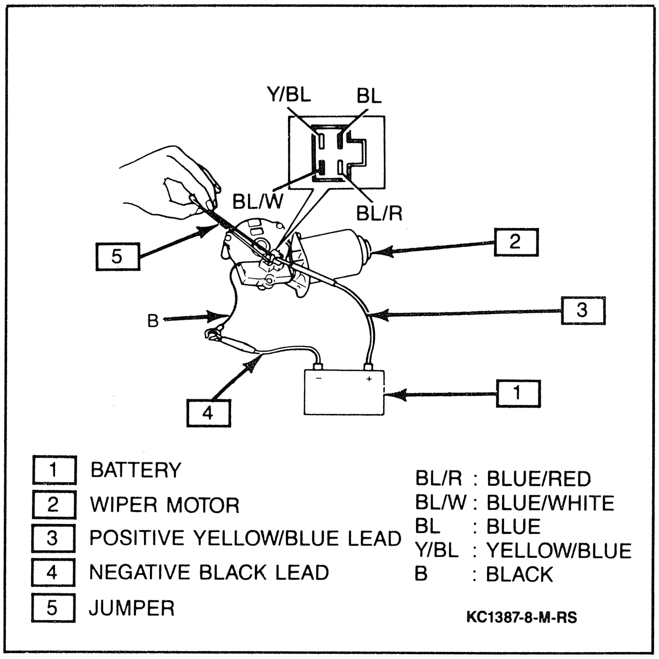

Y/BL
BL
BL/W
BL/R
5
2
B
3
4
1
1 BATTERY
2 WIPER MOTOR
3 POSITIVE YELLOW/BLUE LEAD
4 NEGATIVE BLACK LEAD
5 JUMPER
BL/R : BLUE/RED
BL/W : BLUE/WHITE
BL : BLUE
Y/BL : YELLOW/BLUE
B : BLACK
KC1387-8-M-RS

Figure 52 Wiper Motor Test

Checking Brush And Commutator

Use a circuit tester the check the Blue terminal-to-Black lead wire continuity. If the continuity is poor, check the brush-to-commutator contact area for proper condition. If the area is fouled, use solvent to clean the area. When the surface of the area is coarse or burnt, use sand-paper to polish the surface smooth (Figure 53).

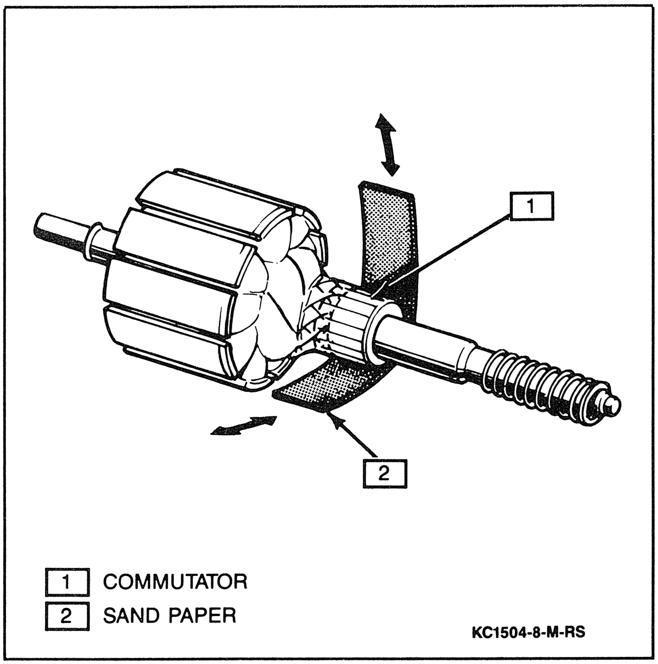

1
2
1 COMMUTATOR
2 SAND PAPER
KC1504-8-M-RS

Figure 53 Resurfacing Commutator

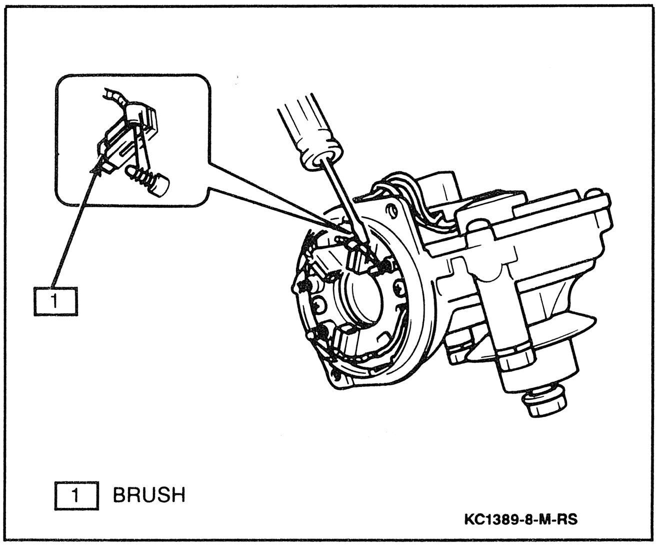

1
1 BRUSH
KC1389-8-M-RS

Figure 54 Assembling Brushes

Before reassembling the wiper motor, install a brush into each brush holder with the brush lead wire hooked around the holder. After the assembly is finished, release the brush (Figure 54).

When assembling the wiper motor cover, be careful of its notch position to assemble it into a specified position (Figure 55).

WASHER PUMP

Connect the battery (+) and (-) terminals to the pump (+) and (-) terminals respectively to check the pump rate (Figure 56).

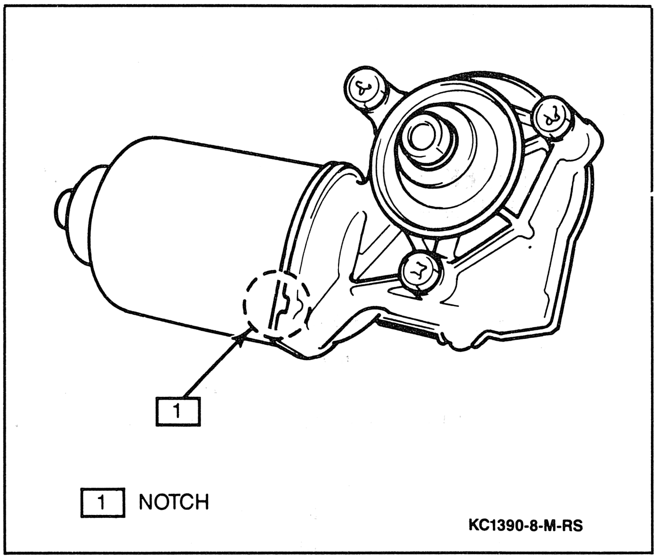

1
1 NOTCH
KC1390-8-M-RS

Figure 55 Assembling Cover To Motor

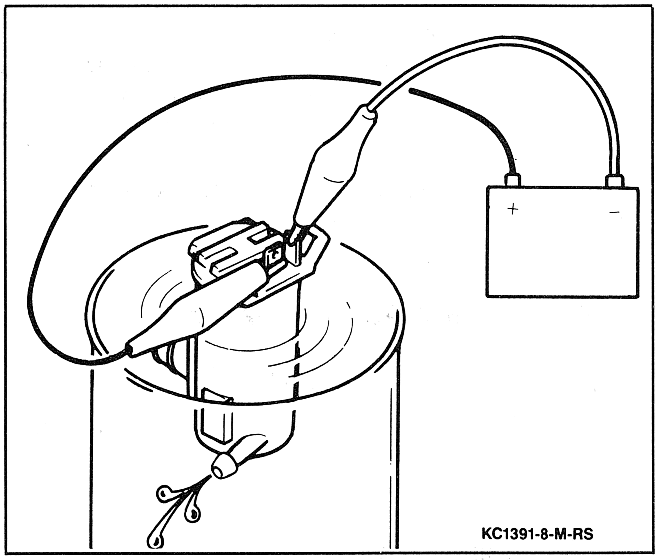

+
−
KC1391-8-M-RS

Figure 56 Checking Washer Pump

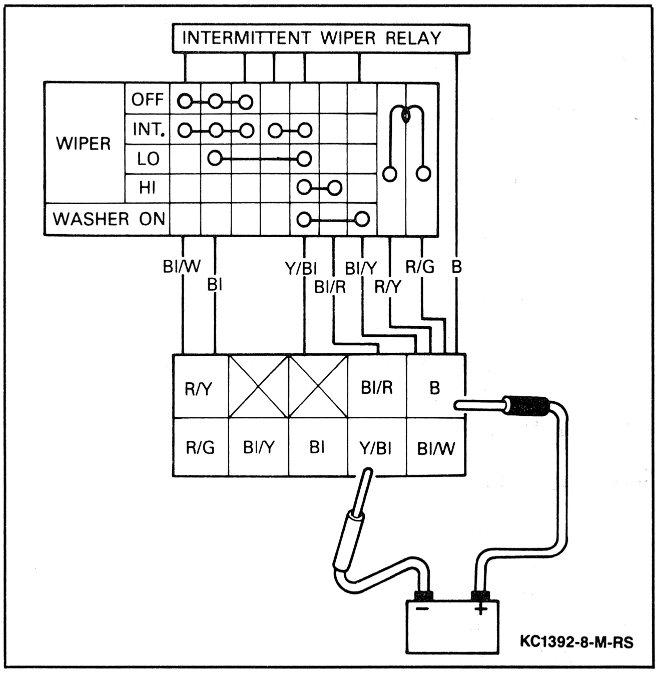

INTERMITTENT WIPER RELAY
WIPER
OFF
INT.
LO
HI
WASHER ON
Bl/W
Bl
Y/Bl
Bl/Y
Bl/R
R/G
R/Y
B
R/Y
Bl/R
B
R/G
Bl/Y
Bl
Y/Bl
Bl/W
−
+
KC1392-8-M-RS

Figure 57 Checking Intermittent Relay

INTERMITTENT WIPER RELAY

Disconnect front windshield wiper/washer switch connector. Connect (+) terminal and (-) terminal of 12V battery to connector terminals. Turn intermittent switch to "OFF" position. If an operating sound is heard from relay, it is operating properly. If test result is not satisfactory, the intermittent wiper relay must be replaced (Figure 57).

ON-VEHICLE SERVICE

FRONT WIPER BLADE ASSEMBLY

←→ Remove or Disconnect (Figure 48)

1. Two screws from the wiper blade assembly.
2. Assembly from wiper arm.

→← Install or Connect

1. Wiper blade assembly to wiper arm.
2. Two screws to the assembly.

FRONT WIPER ARM

←→ Remove or Disconnect (Figure 48)

1. Wiper arm mounting bolt.
2. Wiper arm and blade as an assembly.
3. Wiper blade assembly from wiper arm (See procedure in this section).

→← Install or Connect

1. Wiper blade assembly to wiper arm (See procedure in this section).

2. Wiper arm and blade as an assembly.
3. Wiper arm mounting bolt.

FRONT WIPER MOTOR

Remove or Disconnect (Figure 48)

1. Negative battery cable.
2. Wiper motor electrical connector.
3. Three wiper motor mounting bolts from the wiper motor assembly.
4. Wiper linkage attaching nut and lock washer from the wiper motor.
5. Motor from the vehicle.

Install or Connect

1. Wiper motor to vehicle.
2. Wiper linkage lock washer and attaching nut to the motor.
3. Three wiper motor mounting bolts to the wiper motor assembly.
4. Wiper motor electrical connector.
5. Negative battery cable.

FRONT WIPER LINKAGE

Remove or Disconnect (Figure 48)

1. Negative battery cable.
2. Both wiper arms and blades as assemblies (See procedure in this section).
3. Five push pins from the left hand cowl panel and panel from the vehicle.
4. Three push pins from right hand cowl and panel from the vehicle.
5. Wiper motor from vehicle (See procedure in this section).
6. Four mounting nuts from the wiper linkage assembly.
7. Wiper linkage assembly from vehicle through the left hand side of the vehicle cowl.
8. Pivot arms from the wiper linkage.

Install or Connect

1. Pivot arms to the wiper linkage.
2. Wiper linkage assembly to vehicle through the left hand side of the vehicle cowl.
3. Four mounting nuts to the wiper linkage assembly.
4. Wiper motor to vehicle (See procedure in this section).
5. Right hand cowl panel to the vehicle and three push pins to the panel.
6. Left hand cowl panel to the vehicle and five push pins to the panel.
7. Both wiper arms and blades as assemblies (See procedure in this section).
8. Negative battery cable.

FRONT WIPER WASHER FLUID RESERVOIR AND WASHER PUMP

Remove or Disconnect

1. Negative battery cable.
2. Left hand fender skirt.
3. Fender bracket from underside of reservoir.
4. Washer pump electrical connector and washer hose.
5. Two reservoir mounting nuts and reservoir with washer pump as an assembly.
6. Washer pump from the reservoir.

Install or Connect

1. Washer pump to the reservoir.
2. Reservoir with washer pump as an assembly and two reservoir mounting nuts to reservoir.
3. Washer pump electrical connector and washer hose.
4. Fender bracket to underside of reservoir.
5. Left hand fender skirt.
6. Negative battery cable.

FRONT WIPER WASHER NOZZLE

Remove or Disconnect (Figure 48)

1. Gently disengage lock tabs of nozzle from underside of hood.
2. Nozzle and seal from hood.
3. Washer hose from nozzle.
4. Seal from nozzle.

Install or Connect

1. Seal to nozzle.
2. Washer hose to nozzle.
3. Nozzle and seal to hood by engaging lock tabs of nozzle to underside of hood.

REAR WINDOW DEFOGGER

WIRING CIRCUIT

The optional rear window defogger system has horizontal ceramic silver compound elements and two vertical buss bars. The system is operated by defogger switch in the instrument panel (Figure 58).

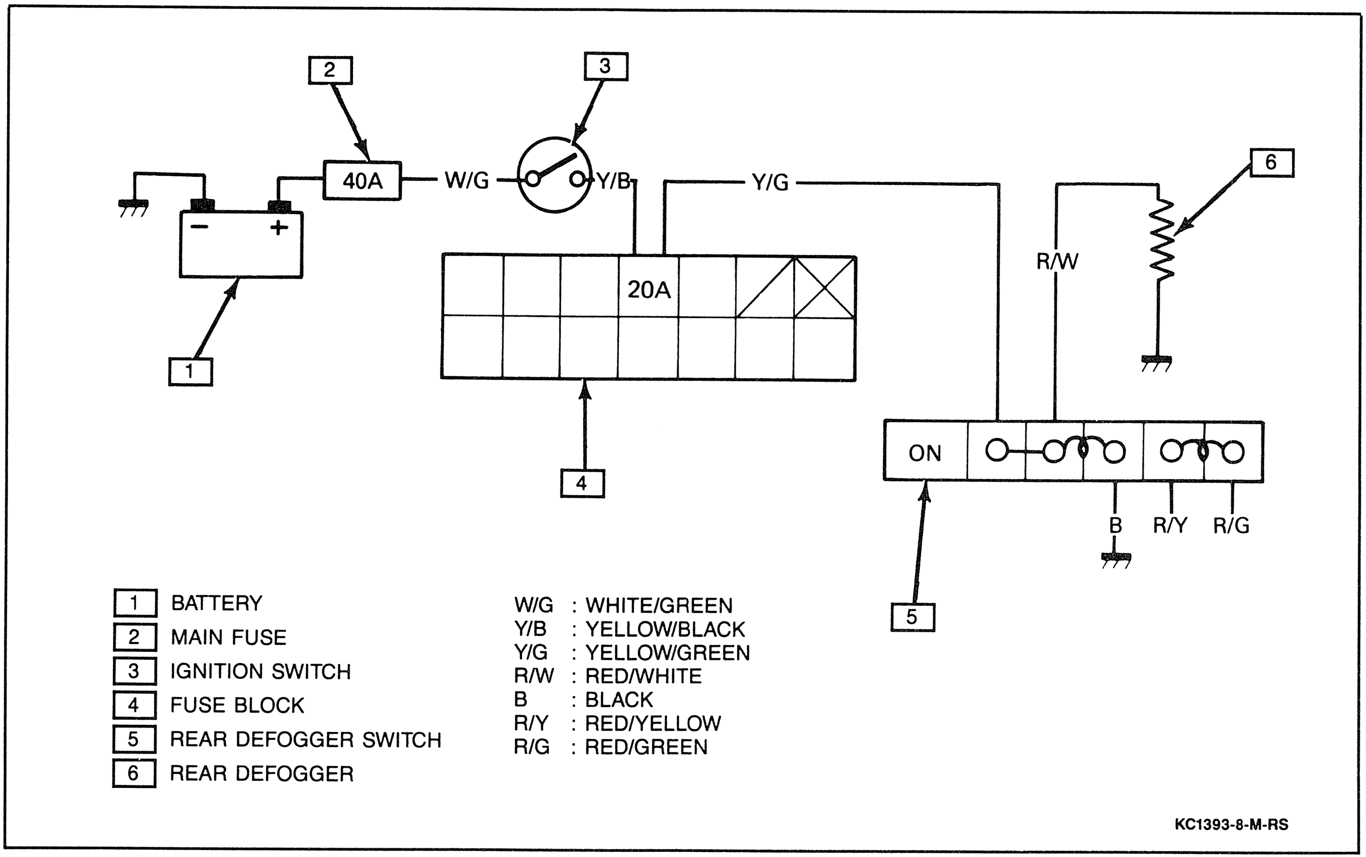

2
3
40A
W/G
Y/B
Y/G
6
R/W
20A
1
4
ON
B
R/Y
R/G
5
1 BATTERY
2 MAIN FUSE
3 IGNITION SWITCH
4 FUSE BLOCK
5 REAR DEFOGGER SWITCH
6 REAR DEFOGGER
W/G : WHITE/GREEN
Y/B : YELLOW/BLACK
Y/G : YELLOW/GREEN
R/W : RED/WHITE
B : BLACK
R/Y : RED/YELLOW
R/G : RED/GREEN
KC1393-8-M-RS

Figure 58 Rear Window Defogger Circuit Wiring Diagram

DIAGNOSIS

Condition	Possible Cause	Correction
Defogger won't work	Defogger switch faulty.	Check switch.
	Defogger heat wire faulty.	Check heat wire.
	Wiring or grounding faulty.	Repair as necessary.

DEFOGGER SWITCH

Use a circuit tester to check the switch for continuity. If the switch has no continuity between terminals, replace the switch (Figure 59).

GRID

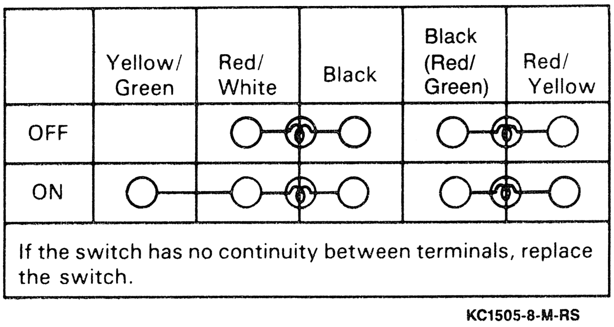
Inspect (Figures 60, 61, and 62)

- When cleaning the rear window glass, use a dry cloth to wipe it along the direction of the horizontal element.
- When cleaning the glass, do not use detergent or abrasive containing glass cleaner.
- When measuring wire grid voltage, use a tester with the negative probe wrapped with tin foil which should be held down on the wire by finger pressure (Figure 60).

1. Checking wire grid damage.
   a. Turn the ignition switch ON.
   b. Turn the defogger switch ON.
   c. Use a voltmeter to check the voltage at the center of each heat wire (Figure 61).

If the voltage obtained is 10V, the wire is damaged between its center and positive end. If the voltage is zero, the wire is damaged between its center and ground (Figure 62).

1. Locating grid damage.
   a. Touch the voltmeter positive (+) lead to the heat wire positive terminal end.
   b. Touch the voltmeter negative lead with a foil strip to the heater grid positive terminal end, then move it along the wire to the negative terminal end.
   c. The place which causes the voltmeter to fluctuate from zero to several volts is point where there is damage.

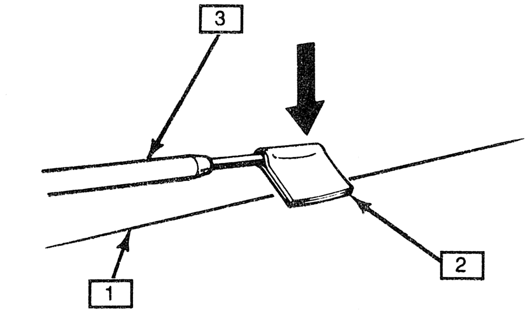


	Yellow/ Green	Red/ White	Black	Black (Red/ Green)	Red/ Yellow
OFF		○	○	○	○
ON	○	○	○	○	○

If the switch has no continuity between terminals, replace the switch.

KC1505-8-M-RS

Figure 59 Checking Switch



1 HEAT WIRE
2 TIN FOIL
3 TESTER PROBE

KC1506-8-M-RS

Figure 60 Grid Voltage Check

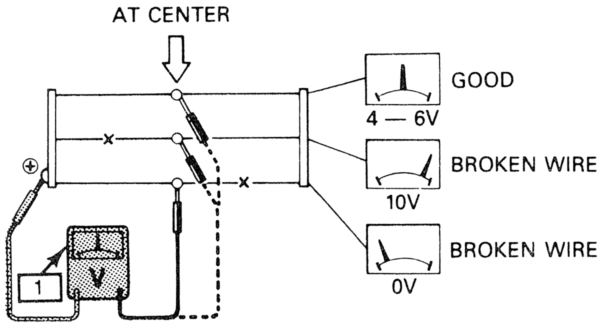
If the heater grid is free from damage, the voltmeter should indicate 12V at the heat wire positive terminal end, and the voltage should gradually decrease toward zero at the other terminal (ground).

ON-VEHICLE SERVICE

DEFOGGER CIRCUIT

When repairing the defogger circuit, use the following procedures (Figure 64).

- Apply masking tape at both the upper and lower sides of grid wire to be repaired.
- Apply commercially-available repair agent with a fine-tip brush.
- Two to three minutes later, remove the masking tape previously applied.
- Allow 24 hours drying times before operating the defogger again; wire with heat gun.



1 VOLTMETER

KC1507-8-M-RS

Figure 61 Checking Grid

Voltage	Criteria
Approx. 5V	Good (No break in wire)
Approx. 10V or 0V	Broken wire

KC1508-8-M-RS

Figure 62 Grid Voltage

When installing the rear window defogger (optional), have the following parts available:

- Back window glass
- Defogger switch
- Defogger lead wires (positive and negative wire)

←→ Remove or Disconnect

1. Negative battery cable.
2. Back window glass (See section 10-2).
3. Rear lid access panel, waterproof film.

→← Install or Connect

Before installing, turn OFF all electrical equipment including the ignition switch.

1. Back window glass (See section 10-2).
2. Lead wires to harness connectors (Figure 65).
3. Defogger switch on instrument panel and connect the switch connector to harness connector (Figure 66).
4. Waterproof film, rear access panel.

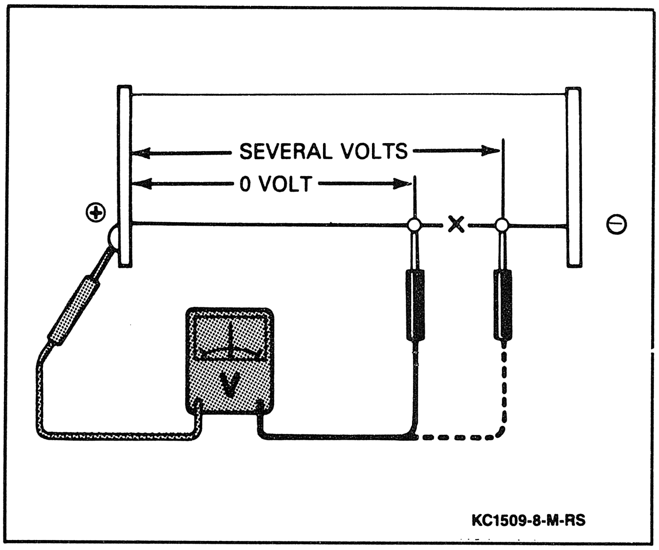

SEVERAL VOLTS
0 VOLT
⊕
X
⊖
V
KC1509-8-M-RS

Figure 63 Grid

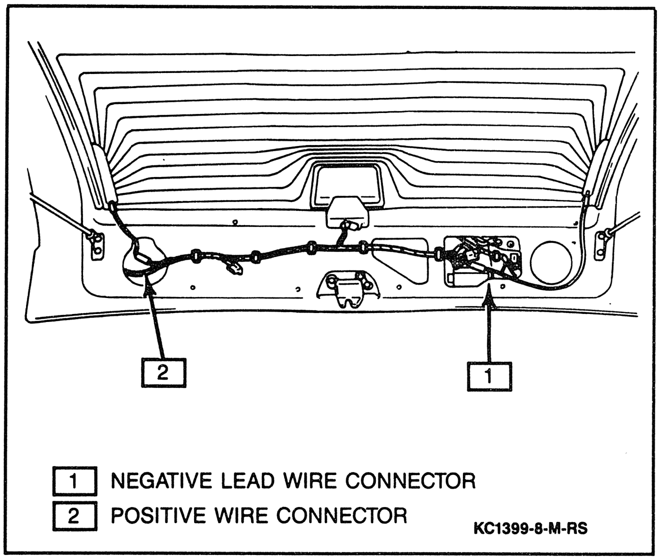

2
1
1 NEGATIVE LEAD WIRE CONNECTOR
2 POSITIVE WIRE CONNECTOR
KC1399-8-M-RS

Figure 65 Defogger Wiring

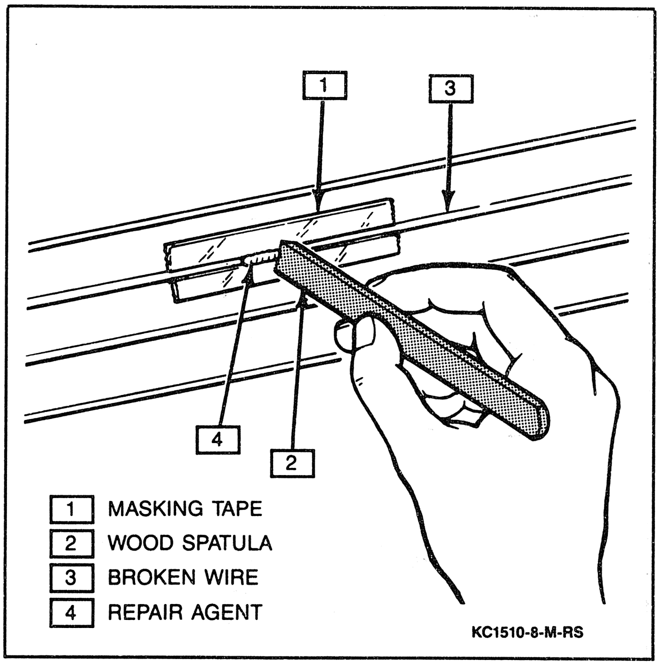

1
3
4
2
1 MASKING TAPE
2 WOOD SPATULA
3 BROKEN WIRE
4 REPAIR AGENT
KC1510-8-M-RS

Figure 64 Grid Repair

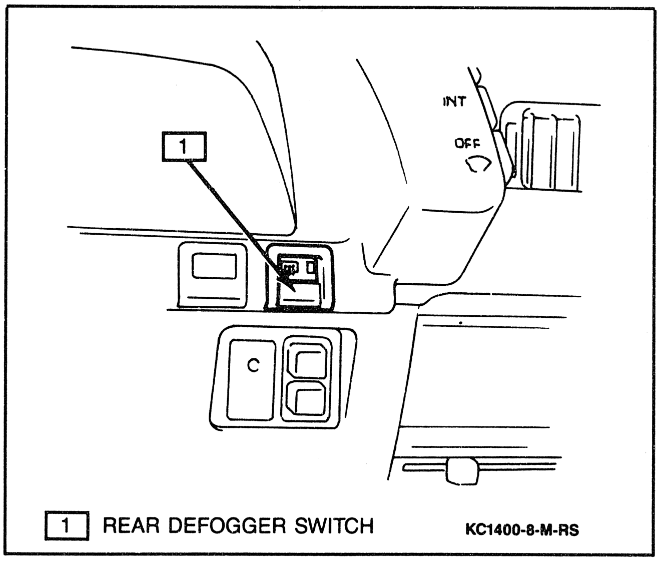

INT
OFF
1
C
1 REAR DEFOGGER SWITCH
KC1400-8-M-RS

Figure 66 Rear Window Defogger Switch

REAR WINDOW WIPER

The optional rear window wiper is a one-speed type and is equipped with a separate-type washer pump provided on the front windshield washer fluid reservoir.

DESCRIPTION OF CIRCUIT AND TROUBLE DIAGNOSIS

See section FRONT WINDSHIELD WIPER (Figure 68).

Rear Wiper/Washer Switch

For rear wiper/washer switch terminal-to-terminal continuity check Figures 69, 70, and 71.

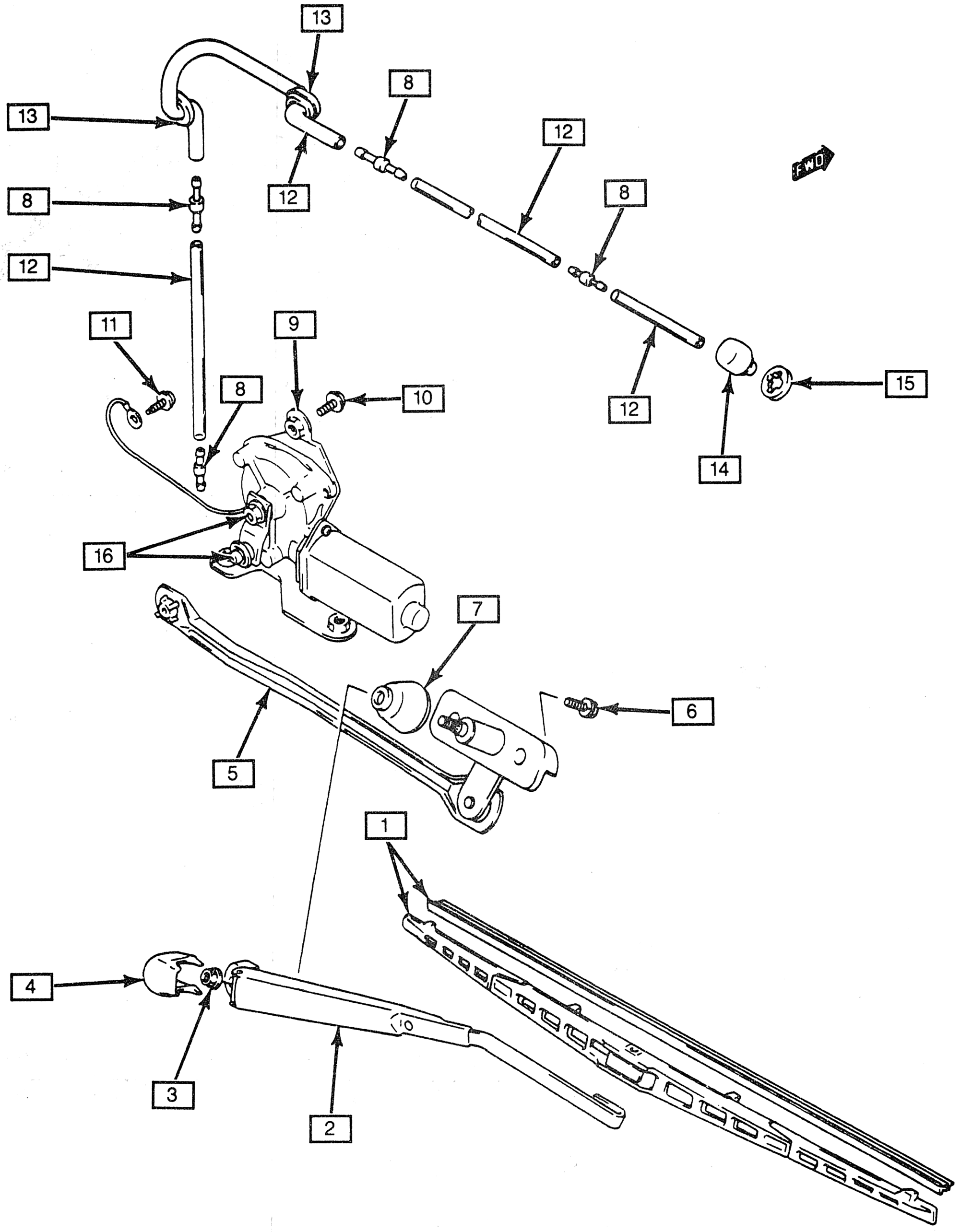
If test results are not satisfactory, the rear wiper/washer switch must be replaced.

Wiper Motor (Rear)

Inspect

1. Use a 12V battery to connect its (+) and (-) terminals to Orange terminal and Black lead cord respectively. If motor operates in the range of 38 to 46 rpm, it is within specifications (Figure 72).
2. Testing "PARK" operation.

Connect battery (+) and (-) terminals to motor Yellow/Blue terminal and Black lead wire. Use jumper to short Orange and Blue/Green terminals to each other to check whether motor shaft stops at given position. Repeat the procedure several times to verify that the arm stops in the same position each time (Figure 73).



1	REAR WIPER BLADE ASSEMBLY	9	REAR WIPER MOTOR ASSEMBLY
2	REAR WIPER ARM	10	REAR WIPER MOTOR MOUNTING SCREW
3	REAR WIPER ARM ATTACHING NUT	11	REAR WIPER MOTOR GROUND SCREW
4	REAR WIPER ARM ATTACHING NUT COVER	12	REAR WIPER WASHER HOSES
5	REAR WIPER LINKAGE ASSEMBLY	13	REAR WIPER WASHER HOSE GROMMETS
6	REAR WIPER LINKAGE ATTACHING BOLT	14	REAR WIPER WASHER NOZZLE
7	REAR WIPER PIVOT CAP	15	REAR WIPER WASHER NOZZLE SEAL
8	REAR WIPER WASHER HOSE CONNECTORS	16	REAR WIPER CRANKING ARM AND ATTACHING NUT

KC1424-8-M-RS

Figure 67 Rear Wiper And Washer Components

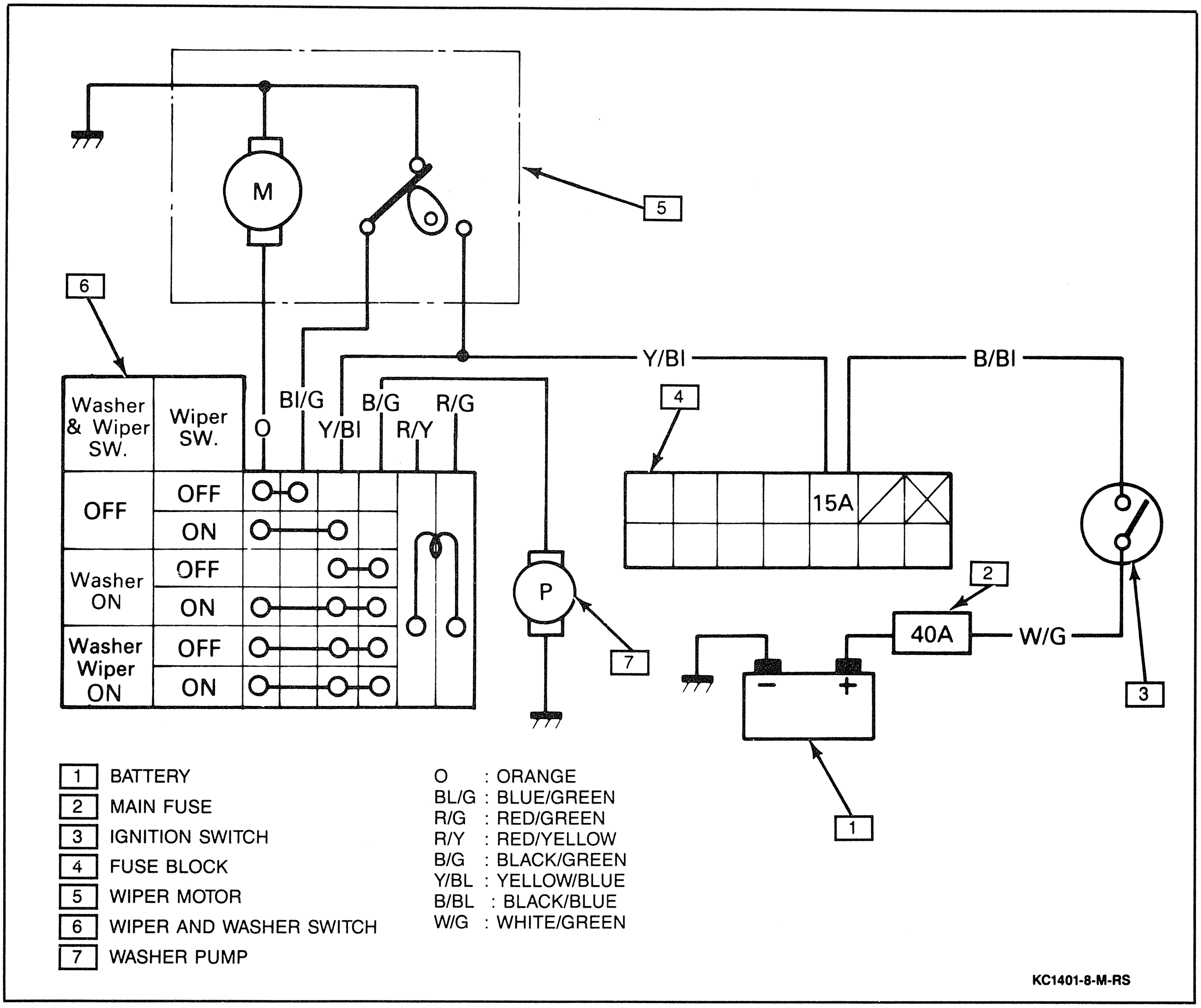

M
5
6
Washer & Wiper SW.
Wiper SW.
OFF
OFF
ON
Washer ON
OFF
ON
Washer Wiper ON
OFF
ON
O
Bl/G
Y/Bl
B/G
R/Y
R/G
Y/Bl
B/Bl
4
15A
P
7
2
40A
W/G
3
1
1 BATTERY
2 MAIN FUSE
3 IGNITION SWITCH
4 FUSE BLOCK
5 WIPER MOTOR
6 WIPER AND WASHER SWITCH
7 WASHER PUMP
O : ORANGE
BL/G : BLUE/GREEN
R/G : RED/GREEN
R/Y : RED/YELLOW
B/G : BLACK/GREEN
Y/BL : YELLOW/BLUE
B/BL : BLACK/BLUE
W/G : WHITE/GREEN
KC1401-8-M-RS

Figure 68 Rear Wiper Wiring Circuit

3. Cleaning brush and commutator.

Use circuit tester to check Orange terminal-to-Black lead wire continuity. If continuity is poor, check brush-and-commutator area for proper contact condition. If fouled, clean area. If surface of area is coarse or burnt, polish area with sandpaper (Figure 74).

Washer Pump

Connect the battery (+) and (-) terminals to the pump (+) and (-) terminals respectively to check pump rate (Figure 8-56).

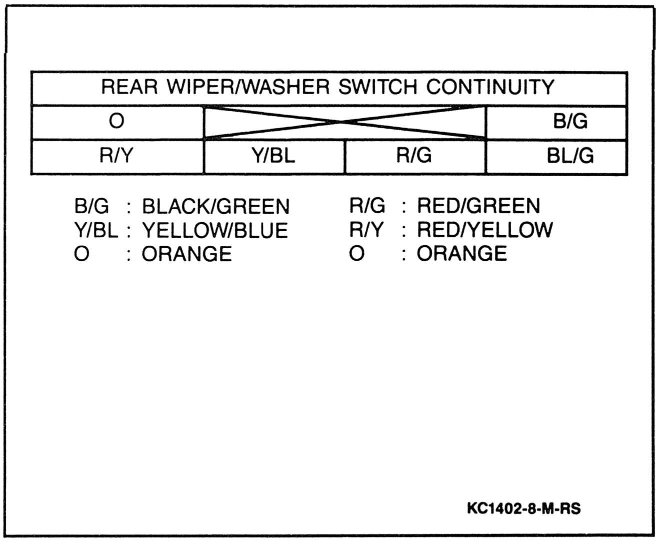

REAR WIPER/WASHER SWITCH CONTINUITY
O
B/G
R/Y
Y/BL
R/G
BL/G
B/G : BLACK/GREEN
Y/BL : YELLOW/BLUE
O : ORANGE
R/G : RED/GREEN
R/Y : RED/YELLOW
O : ORANGE
KC1402-8-M-RS

Figure 69 Rear Wiper/Washer Continuity Check

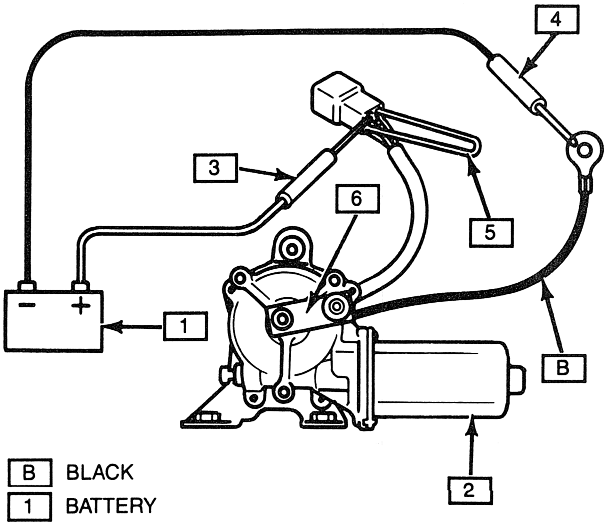
CONTINUITY BETWEEN TERMINALS

Switch Position		Terminal-to-Terminal Continuity
Washer & Wiper	Wiper	
OFF	OFF	BL/G — O
	ON	Y/BL — O
WASHER ON	OFF	B/G — Y/BL
	ON	B/G — Y/BL — O
WASHER & WIPER ON	OFF	B/G — Y/BL — O
	ON	B/G — Y/BL — O

R/G, an illumination light lead wire of light switch, produces constant R/G - R/Y continuity

KC1403-8-M-RS

Figure 70 Rear Wiper/Washer Switch Terminal-To-Terminal Continuity Chart



B BLACK

1 BATTERY

2 WIPER MOTOR

3 BATTERY POSITIVE TERMINAL-TO-YELLOW/BLUE TERMINAL CONNECTION

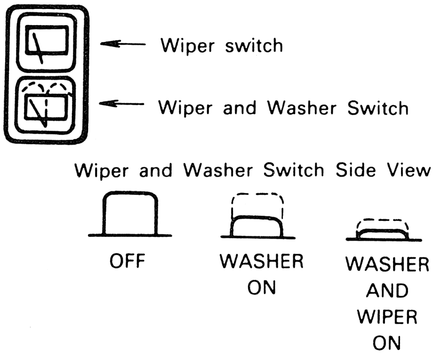
4 BATTERY NEGATIVE TERMINAL-TO-BLACK WIRE CONNECTION

5 JUMPER (ORANGE TERMINAL-TO-BLUE/GREEN TERMINAL CONNECTION)

6 CRANK ARM

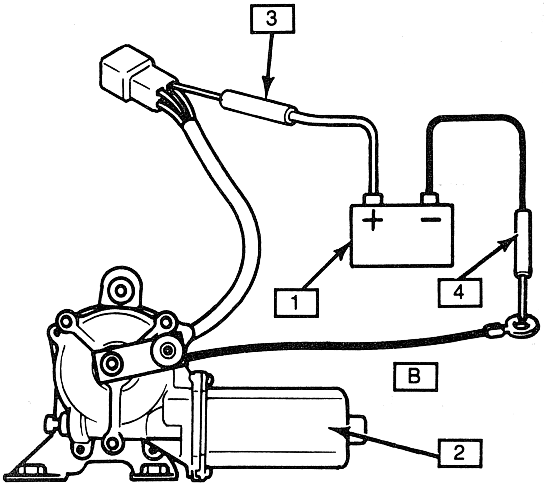
KC1406-8-M-RS

Figure 73 Rear Wiper Motor Test


Wiper switch
Wiper and Washer Switch
Wiper and Washer Switch Side View
OFF
WASHER ON
WASHER AND WIPER ON

KC1404-8-M-RS

Figure 71 Rear Wiper/Washer Switch Positions



B BLACK

1 BATTERY

2 WIPER MOTOR

3 BATTERY POSITIVE TERMINAL-TO-ORANGE TERMINAL CONNECTION

4 BATTERY NEGATIVE TERMINAL-TO-BLACK WIRE WIRE CONNECTION

KC1405-8-M-RS

Figure 72 Rear Wiper Motor Test

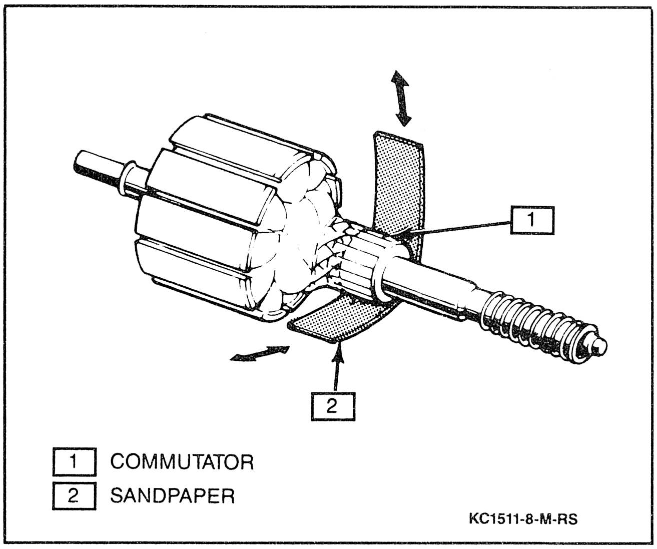


Figure 74 Cleaning Commutator

ON-VEHICLE SERVICE

REAR WIPER BLADE ASSEMBLY

Remove or Disconnect (Figure 67)

1. Disengage lock tab from the wiper arm.
2. Wiper blade assembly from the wiper arm.
3. Rubber wiper blade from the blade assembly.

Install or Connect

1. Rubber wiper blade to the blade assembly.
2. Wiper blade assembly to the wiper arm by engaging lock tab to the wiper arm.

REAR WIPER ARM

Remove or Disconnect (Figure 67)

1. Wiper arm attaching nut cover and nut.
2. Wiper arm and blade as an assembly.
3. Wiper blade assembly from wiper arm (See procedure in this section).

Install or Connect

1. Wiper blade assembly to wiper arm (See procedure in this section).
2. Wiper arm and blade as an assembly.
3. Wiper arm attaching nut and nut cover.

REAR WIPER MOTOR

Remove or Disconnect (Figure 67)

1. Negative battery cable.
2. Right and left hand rear speakers from the rear lid access panel (See section 9A).
3. Nine push pins from the rear lid access panel.
4. Panel from vehicle.
5. Wiper motor electrical connector.
6. Rear wiper motor ground screw.
7. Wiper cranking arm attaching nut from the wiper motor shaft.
8. Three wiper motor mounting screws from the wiper motor assembly.
9. Wiper motor assembly from vehicle.

Install or Connect

1. Wiper motor assembly to vehicle.
2. Three wiper motor mounting screws to the wiper motor assembly.
3. Wiper cranking arm attaching nut to the wiper motor shaft.
4. Rear wiper motor ground screw.
5. Wiper motor electrical connector.
6. Rear lid access panel to vehicle.
7. Nine push pins to the rear lid access panel.
8. Right and left hand rear speakers to the rear lid access panel (See section 9A).
9. Negative battery cable.

REAR WIPER LINKAGE

Remove or Disconnect (Figure 67)

1. Negative battery cable.
2. Wiper arm and blade as an assembly (See procedure in this section).
3. Wiper motor from vehicle (See procedure in this section).
4. Two mounting nuts from the wiper linkage assembly.
5. Assembly from vehicle through the left hand side of the rear lid.
6. Pivot cap from the rear window.
7. Pivot arms from the wiper linkage.

Install or Connect

1. Pivot arms to the wiper linkage.
2. Pivot cap to the rear window.

3. Wiper linkage assembly to vehicle through the left hand side of the rear lid.
4. Two mounting nuts to the wiper linkage assembly.
5. Wiper motor to vehicle (See procedure in this section).
6. Wiper arm and blade as an assembly (See procedure in this section).
7. Negative battery cable.

WIPER WASHER FLUID RESERVOIR AND REAR WASHER PUMP

Remove or Disconnect

1. Negative battery cable.
2. Left hand fender skirt.
3. Fender bracket from underside of reservoir.
4. Two washer pump electrical connectors and washer hoses.
5. Two reservoir mounting nuts and reservoir with washer pumps as an assembly.
6. Rear washer pump from the reservoir.

Install or Connect

1. Rear washer pump to the reservoir.
2. Reservoir with washer pumps as an assembly and two reservoir mounting nuts.
3. Washer pump electrical connectors and washer hoses.
4. Fender bracket to underside of reservoir.
5. Left hand fender skirt.
6. Negative battery cable.

REAR WIPER WASHER NOZZLE

Remove or Disconnect (Figure 67)

1. Nozzle from rear hatch.
2. Washer hose from nozzle.
3. Washer nozzle and seal from vehicle.
4. Nozzle seal from nozzle.

Install or Connect

1. Nozzle seal to nozzle.
2. Nozzle and seal as an assembly to the vehicle.
3. Washer hose to nozzle.
4. Nozzle to rear hatch.

DAYTIME RUNNING LAMPS (IF EQUIPPED)

GENERAL DESCRIPTION

Daytime Running Lamps are standard equipment on models of this vehicle which are designated for sale in Canada. There is a Daytime Running Lamp (D.R.L.) indicator lamp on the instrument panel of these vehicles. Running the low beams at a lower than normal output, the D.R.L. system operates under the

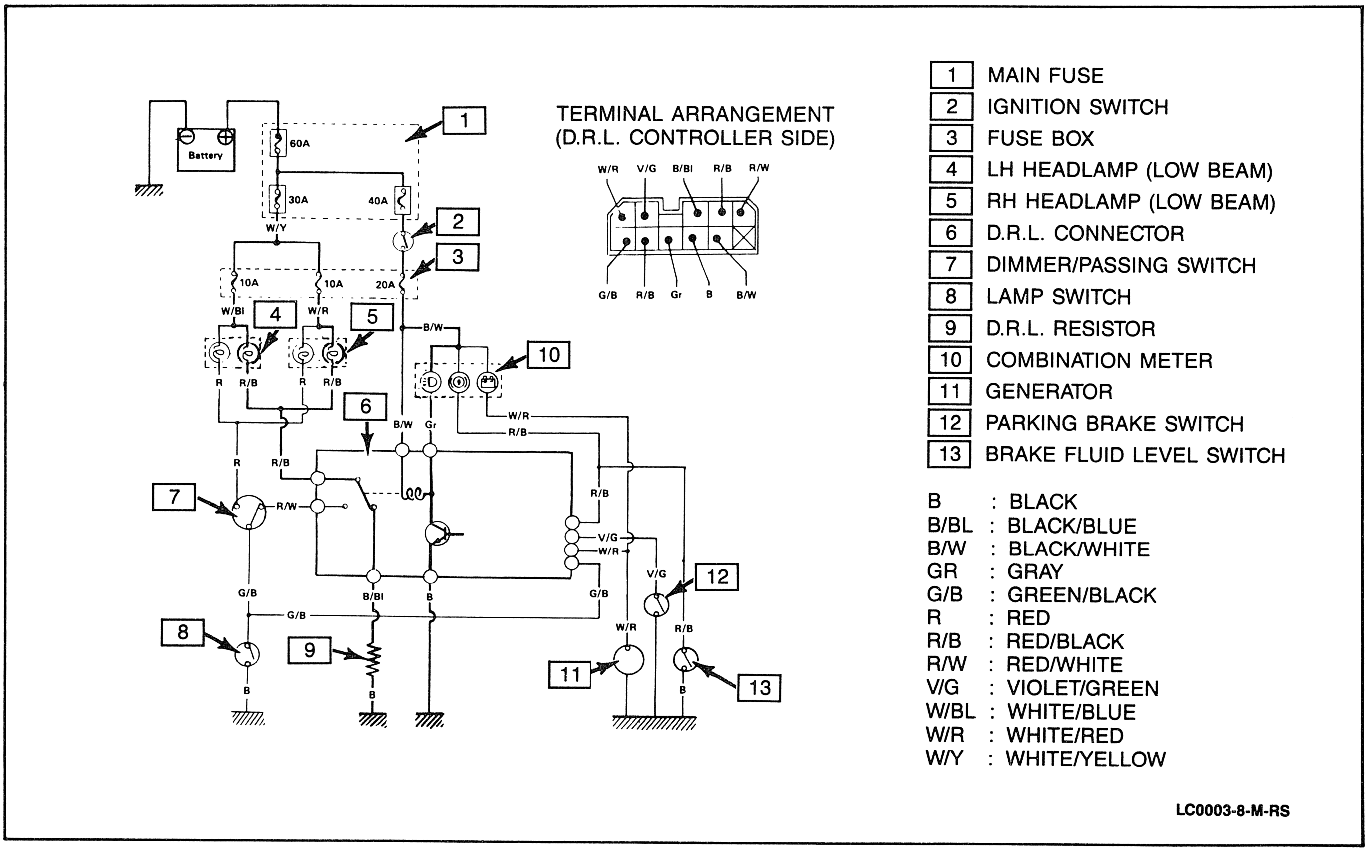
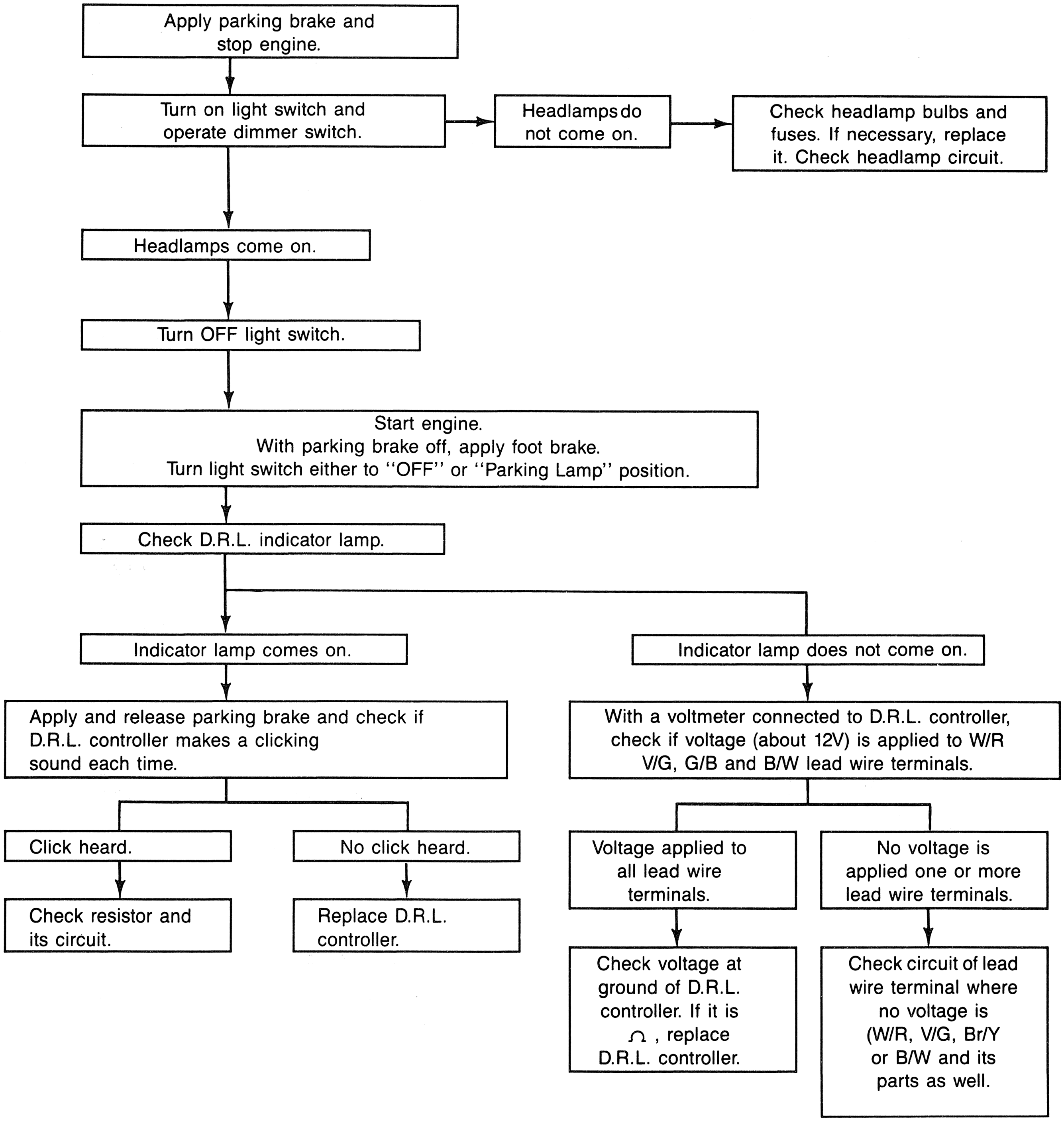

Battery
60A
30A
40A
W/Y
10A
10A
20A
W/Bl
W/R
R
R/B
B/W
Gr
R/W
G/B
B/Bl
B
V/G
TERMINAL ARRANGEMENT
(D.R.L. CONTROLLER SIDE)
W/R V/G B/Bl R/B R/W
G/B R/B Gr B B/W
1 MAIN FUSE
2 IGNITION SWITCH
3 FUSE BOX
4 LH HEADLAMP (LOW BEAM)
5 RH HEADLAMP (LOW BEAM)
6 D.R.L. CONNECTOR
7 DIMMER/PASSING SWITCH
8 LAMP SWITCH
9 D.R.L. RESISTOR
10 COMBINATION METER
11 GENERATOR
12 PARKING BRAKE SWITCH
13 BRAKE FLUID LEVEL SWITCH
B : BLACK
B/BL : BLACK/BLUE
B/W : BLACK/WHITE
GR : GRAY
G/B : GREEN/BLACK
R : RED
R/B : RED/BLACK
R/W : RED/WHITE
V/G : VIOLET/GREEN
W/BL : WHITE/BLUE
W/R : WHITE/RED
W/Y : WHITE/YELLOW
LC0003-8-M-RS

Figure 75 Daytime Running Lamps System Circuit



Apply parking brake and stop engine.

Turn on light switch and operate dimmer switch.

Headlamps do not come on.

Check headlamp bulbs and fuses. If necessary, replace it. Check headlamp circuit.

Headlamps come on.

Turn OFF light switch.

Start engine.
With parking brake off, apply foot brake.
Turn light switch either to "OFF" or "Parking Lamp" position.

Check D.R.L. indicator lamp.

Indicator lamp comes on.

Apply and release parking brake and check if D.R.L. controller makes a clicking sound each time.

Click heard.

Check resistor and its circuit.

No click heard.

Replace D.R.L. controller.

Indicator lamp does not come on.

With a voltmeter connected to D.R.L. controller, check if voltage (about 12V) is applied to W/R V/G, G/B and B/W lead wire terminals.

Voltage applied to all lead wire terminals.

Check voltage at ground of D.R.L. controller. If it is Ω, replace D.R.L. controller.

No voltage is applied one or more lead wire terminals.

Check circuit of lead wire terminal where no voltage is (W/R, V/G, Br/Y or B/W and its parts as well.

Figure 76 Daytime Running Lamps Diagnosis

Trouble	Possible Cause	Correction
D.R.L. system remains operating even after engine stop.	D.R.L. controller faulty. W/R circuit faulty.	Replace controller. Repair.
D.R.L. system remains operating even after parking brake applied.	Parking brake switch faulty. V/G circuit faulty.	Replace switch. Repair.
D.R.L. system remains operating even after lamp switch turned ON.	Lamp switch faulty. G/B circuit or its ground faulty.	Repair or replace switch. Repair.

LC0007-8-M-RS

Figure 77 Daytime Running Lamps Failure Diagnosis

following conditions:

1. The engine is running.
2. The parking brake is not applied.
3. The headlamp switch is in either the "OFF" or "PARKING LAMP" position.

DIAGNOSIS
Figures 76 and 77

Refer to Figures 76 and 77 for Daytime Running Lamps diagnosis.

ON-VEHICLE SERVICE

DAYTIME RUNNING LAMP CONTROLLER
Figure 78

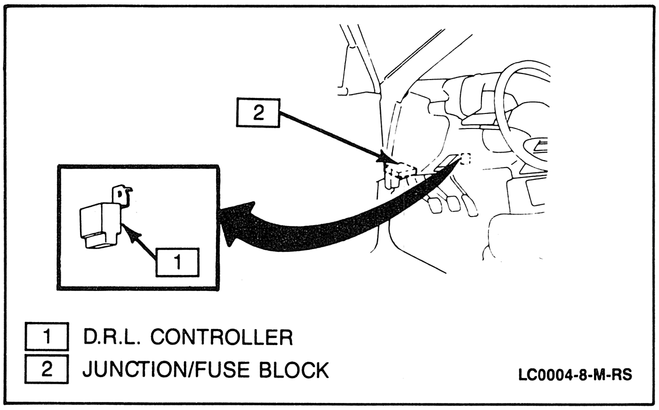

2
1
1 D.R.L. CONTROLLER
2 JUNCTION/FUSE BLOCK
LC0004-8-M-RS

Figure 78 Daytime Running Lamps Controller Location

Remove or Disconnect

1. Daytime running lamp controller mounting screw.
2. Daytime running lamp controller.

Install or Connect

1. Daytime running lamp controller with mounting screw.

DAYTIME RUNNING LAMP RESISTOR
Figure 79

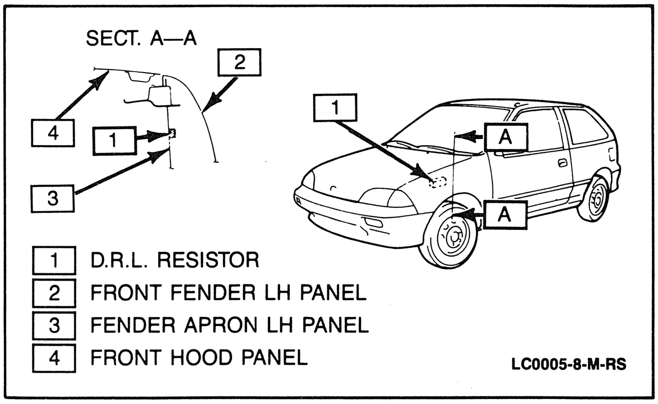

SECT. A—A
2
4
1
3
1
A
A
1 D.R.L. RESISTOR
2 FRONT FENDER LH PANEL
3 FENDER APRON LH PANEL
4 FRONT HOOD PANEL
LC0005-8-M-RS

Figure 79 Daytime Running Lamps Resistor Location

Remove or Disconnect

1. Pry resistor from fender panel.
2. Resistor from wiring harness by cutting wires.

Install or Connect

1. Splice new resistor to wiring harness.
2. Resistor to fender panel.

SECTION 9A

RADIO

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Radio 9A-4
Radio Speaker 9A-4
Antenna 9A-4

GENERAL INFORMATION

SPEAKERS

All factory equipped sound systems have ungrounded speakers. Installing add-on tape players, CB's or other units which use the car speakers may damage sound system.

FM STEREO

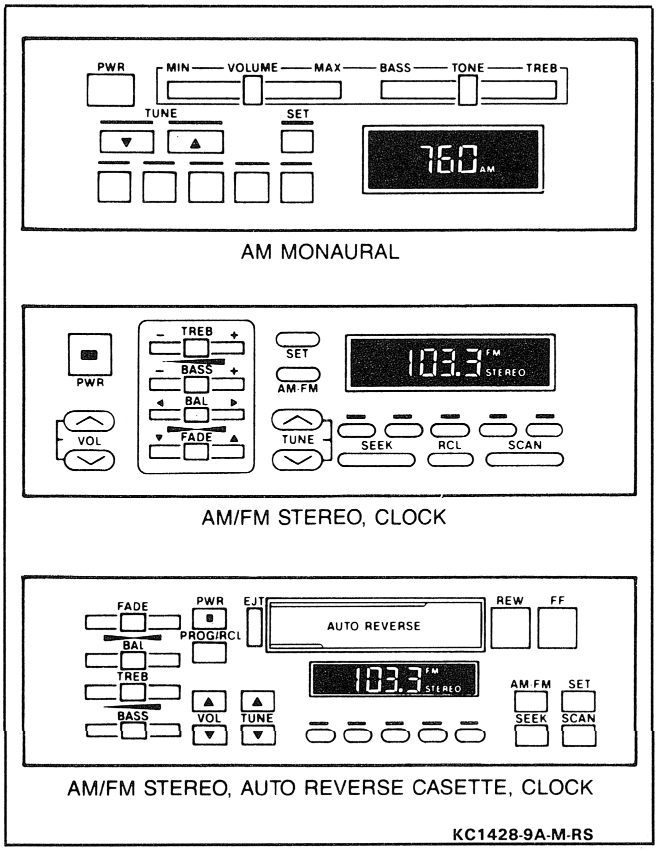
FM broadcasts are the "line of sight" from station antenna to receiving antenna. The range is often limited to 25 miles (40 km) or less for steady reception. Tall buildings or hills may cause flutter or noise which is not the fault of the radio; select a stronger station for clear sound.

STEREO SOUND

All factory equipped sound systems with an FM stereo radio will switch to stereo operation whenever an FM stereo broadcast is being received, and an indicator in the dial will light. "left" and "right". Stereo sound is noticeably more realistic to the ear.

ANTENNA

The antenna is located in the left front pillar. To extend it, pull the knob up. Antenna must be kept clean for quality performance.


PWR
MIN
VOLUME
MAX
BASS
TONE
TREB
TUNE
SET
76.0 AM
PWR
TREB
BASS
BAL
FADE
SET
AM·FM
103.3 FM STEREO
VOL
TUNE
SEEK
RCL
SCAN
FADE
BAL
TREB
BASS
PWR
EJT
PROG/RCL
AUTO REVERSE
REW
FF
103.3 FM STEREO
AM·FM
SET
VOL
TUNE
SEEK
SCAN
KC1428-9A-M-RS

AM MONAURAL

AM/FM STEREO, CLOCK

AM/FM STEREO, AUTO REVERSE CASETTE, CLOCK

Figure 1 Radios

DIAGNOSIS

CONDITION	POSSIBLE CAUSE	CORRECTION
Radio does not operate	Blown radio fuse.	Replace.
	Open in WHT/BLK wire between fuse block and radio.	Repair.
	Open in BLK wire between radio and ground.	Repair.

	Defective radio.	Repair.
AM band does not operate (FM band operates)	Poor antenna connections.	Repair.
	Defective antenna or cable.	Replace.
	Defective radio.	Replace.
FM Band does not operate (AM band operates)	Defective radio.	Replace.
Radio operates but reception is poor (weak signal strength)	Poor antenna connections.	Repair.
	Defective radio.	Replace.
Radio operates but generates noise (static)	Poor antenna connections.	Repair.
	Defective antenna or cable.	Replace.
	Defecive radio noise suppressor.	Replace.
	Defective spark plug wires.	Replace.
	Worn spark plugs.	Replace.
	Defective radio.	Replace.
Any one speaker not operating	Open in wires between radio and speaker.	Repair.
	Defective speaker.	Replace.
	Radio defective.	Replace.
Clock does not operate	Open in WHT wire between fuse block and radio.	Repair.
	Defective radio.	Replace.

OPERATION

AM MONAURAL

Figure 1

To Operate The Radio

- Turn Radio On (PWR) - Press "PWR" button; Press again to turn radio off (Radio also goes off with ignition key).
- Adjust Volume - Slide "VOLUME" control toward "MIN" to decrese volume or toward "MAX" to increase volume.
- Select Stations - Use one of two methods of tuning: Manual Tuning - Press and hold "TUNE" button with arrow pointing up or down. Release as desired frequency is approached. (Station frequency will be displayed). Station Buttons - Press one of five station buttons to tune a preset station (See the following station set-up procedure).

NOTICE: The last station heard will be stored in memory, and will return the next time the radio is turned on.

- Setting Favorite Station - Locate a favorite station by using either "TUNE (UP)" or "TUNE (DOWN)" button. Press "SET" button and within five seconds, press one of the five station buttons. The radio will return to the station frequency whenever that station button is pressed.

NOTICE: A total of five stations can be preset.

- Tone Settings - Slide "TONE" control towards "BASS" to increase bass. Slide "TONE" control towards "TREB" to increase treble.

NOTICE: Slide "TONE" control to middle position for normal tone adjustment.

AM/FM STEREO, CLOCK

AM/FM STEREO, CLOCK, AND AUTO REVERSE CASSETTE

The following operation is common to both radios (Figure 1).

To Operate The Radio

- Turn Radio On (PWR) - Press "PWR" button; press again to turn radio off. (Radio also goes off with ignition key.)
- Adjust Volume (VOL) - Press "VOL" (up button)to increase volume; press "VOL" (down button) to decrease volume.

NOTICE: When radio is turned off, the last volume setting is stored in memory. When turned back on, it will return to that level.

- Select AM or FM - Press "AM-FM" button to select desired band ("AM" or "FM" will be displayed depending on band choice).

NOTICE: The last station heard on each will be stored in memory. When switching back to that band, it will automatically return.

- Select Stations - Use one of the four methods of tuning: Seek - Press "SEEK" button to automatically search for the next listenable station. Scan - Press "SCAN" button to sample each station for a few seconds; press again to stop scanning (If radio is in "SCAN" mode, the word "SCAN" will be displayed). Manual Tuning - Press and hold "TUNE" with arrow pointing up or down. Release as desired frequency is approached.
- Setting Favorite Stations - Locate a favorite station by using the "SEEK", "SCAN", or up-down tuning buttons. Then press the "SET" button; within five seconds press one of the five station buttons (The word "SET" plus station frequency will be displayed). The radio will now return to the station frequency whenever that station button is depressed.

NOTICE: A total of ten stations can be preset (five AM and five FM).

- Setting Time of Day: To set hours - Press and hold"SET" button and **at the same time** , press and hold "SEEK" button until correct hour appears. To set minutes - Press and hold "SET" button and **at the same time** , press and hold "SCAN" button until correct minute appears (Time can also be set with tape playing).
- To Display Time with Ignition Off - Press "RCL" button or "PROG/RCL" button if you have radio with tape player.
- To Display Frequency - If radio is turned on and time is being displayed, press "RCL" button (PROG/RCL on radio with tape player), to display frequency.
- To Receive Stereo - The radio will automatically switch to stereo when tuned to an FM station broadcasting stereo, and the stereo indicator light, "ST" will be displayed.
- Speaker Balance (BAL) - Slide balance control, "BAL", towards left to adjust sound balance to left speakers or right to adjust sound balance to right speakers.

NOTICE: Slide balance control to center position to equalize sound balance between right and left speakers.

- Speaker Front - Rear (FADE) - Slide fade control, "FADE", towards left to adjust sound balance to rear of car or towards right to adjust sound balance to front of car.

NOTICE: Slide fade control to center position to equalize sound balance between front and rear speakers.

- Tone Settings - Treble and Bass: Treble - Slide "TREB" control toward left to decrease treble. Slide "TREB" control toward right to increase treble ("TREB" control set at center position balances treble response). Bass - Slide "BASS" control toward right to increase bass ("BASS" control set at center position balances bass response).

To Operate Tape Player (If Equipped)

- Inserting Cassette Tape - Insert tape into door marked "AUTO REVERSE" with exposed edge of tape to the right.
- Reversing Sides - Press "PROG/RCL" button to play other side of tape.
- Auto-Reverse Feature - When end-of-tape isreached, the unit will automatically reverse direction and play other side of the tape as indicated by the lighted arrow.

NOTICE: A lighted arrow will be displayed. When the arrow points up, the top side of the tape (as inserted) is playing. When the arrow points down, the bottom side of the tape is playing.

- Fast Forward (FF) - Press "FF" button to activate; depress "EJT" button half way to stop fast motion and return to playing speed.

- Fast Reverse (REW) - Press "REW" button to activate; depress "EJT" button half way to stop fast motion and return to playing speed.
- To Eject Tape (EJT) and Return to "Radio" - Firmly press "EJT" button.

NOTICE: Power button must be "ON". When tape is ejected, the radio becomes operative. When the ignition is turned off, internal pressure on the tape is automatically removed so that no damage will occur.

Tape and Tape Player Care

Optimum performance can be maintained by cleaning the internal tape head, capstan, and pinch roller periodically (approx. each 100 hours of operation). This can be done by inserting a nonabrasive cleaning cassette in place of the music tape.

Store cassettes away from extreme heat or direct sunlight. Protect the open ends from dirt or damage; store them in their original cases or other protective cases.

For best results, 120 minute tapes are not recommended.

When leaving the car, cassettes may be left in the tape player if the deck is in the "auto reverse" type (tapes are either automatically ejected or internally protected).

ON-VEHICLE SERVICE

RADIO REMOVAL

When removing the radio, refer to BODY AND CHASSIS ELECTRICAL (Section 8).

RADIO SPEAKER REMOVAL

SPEAKER (REAR)

←→ Remove or Disconnect

1. Negative battery cable.
2. Four speaker grille attaching screws and the grille from the rear lid access panel.
3. Speaker electrical connector and remove speaker from vehicle.

→← Install or Connect

1. Speaker and speaker electrical connector.
2. Speaker grille to lid access panel and four attaching screws.
3. Negative battery cable.

SPEAKER (FRONT)

←→ Remove or Disconnect

1. Battery ground cable.

2 Front speaker garnish cover by depressing two push pins.

3. Two mounting screws from the speaker.
4. Speaker electrical connector and remove speaker from vehicle.

→← Install or Connect

1. Speaker to vehicle and speaker electrical.
2. Two mounting screws to speaker.
3. Speaker garnish cover.
4. Negative battery cable.

ANTENNA

←→ Remove or Disconnect

1. Battery ground cable.
2. Left heater duct (to aid in installation of antenna lead in wire).
3. Antenna cable from radio and bracket. Attach a piece of mechanic's wire to antenna cable to aid in the removal and installation of cable through pillar.
4. Mast screws.
5. Antenna mast, guiding wire attached to antenna cable through pillar.
6. Antenna cable to mechanics wire.

→← Install or Connect

1. New attenna cable from mechanic's wire.
2. Guide antenna cable and mast through pillar with aid of mechanic's wire.
3. Mast screws.
4. Left heater duct.
5. Battery ground cable.

Geo METRO

BODY SERVICE

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This section contains essential removal, installation adjustment and maintenance procedures for servicing Geo METRO body styles. This information is current at time of publication approval.

SECTION 10-1

GENERAL INFORMATION

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Replacement Lock Cylinder 10-1-1
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LOCK CYLINDER CODING

KEY IDENTIFICATION AND USAGE

One key is used for ignition, door, instrument panel compartment and trunk lock cylinders. The keys are cut on both edges to make them reversible (Figures 1 and 2).

Key identification is obtained from the five character key code stamped on the key code tag. From this key code, the key code cutting combination can be determined from a code list (available to owners of key cutting equipment from suppliers).

If key codes are not available from records or tags, the key code can be obtained from the right hand door lock cylinder (if lock has not been replaced). Lock cylinders supplied by the factory as service parts are unmarked.

If the original key is available, the key code cutting combination can be determined by laying the key on the diagram shown.

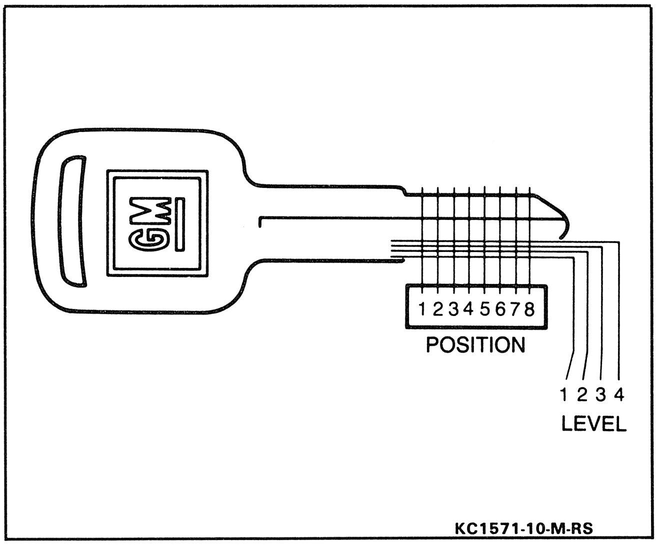


Figure 1 Key Code Diagram

CUTTING KEYS

- Determine special code from the code list or the key code diagram.
- Cut a blank key to the proper level for eight tumbler positions.
- Check key operation in the lock cylinder.

REPLACEMENT LOCK CYLINDER

Lock cylinders are available from service parts as a complete assembly with key. Tumblers are not available from service parts. If repairs to the tumbler are needed, replace it with a new lock cylinder and key.

ASSEMBLING AND CODING LOCK CYLINDERS

There are no internal parts available for lock cylinders, so there are no assembling and coding procedures.

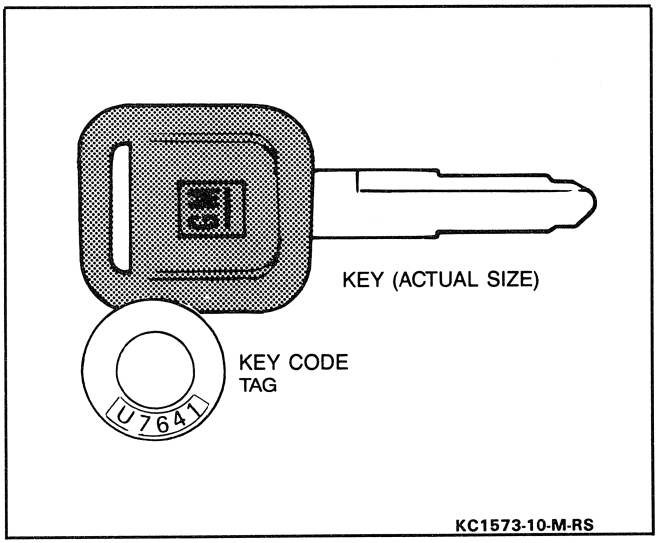


Figure 2 Key Code Tag

ADHESIVE BODY SIDE MOLDING

The body side moldings that are attached to the body with adhesive tape. To ensure a good molding replacement (new or old moldings), the panel surface should be warm (21°C to 32°C or 70°F to 90°F), clean and free of any wax or oily film. Two methods are listed to attach loose molding ends or completely removed moldings.

Molding End Loose

1. Wash affected area with soap and water and wipe dry. Wipe panel and adhesive side of molding with a clean rag using oil-free naphtha or alcohol. If molding has pulled loose from adhesive backing (tape remains on body panel), do not remove tape from body. Clean back of molding and tape on body with oil-free naphtha or alcohol and proceed with step 3.
2. If needed, apply a length of masking tape as a molding guide. A straightedge may also be used in most cases.
3. Apply adhesive to back of molding and press in place. If Loctite 414 adhesive (#1052283) or equivalent is used, apply constant pressure to molding for 30 seconds or until a firm bond has been made.

Molding Completely Removed

1. Wash affected panel area with soap and water and wipe dry. Remove all traces of adhesive from body panel and back of molding using oil-free naphtha or alcohol.
2. Mark proper position of molding with a length of masking tape. Use adjacent moldings as a guide, if applicable (Figure 3).
3. If body is below 21°C (70°F) due to shop temperature or outside temperature, warm body panel with heat gun while proceeding with step 4.
4. Apply a double-coated acrylic foam tape such as 3M Super Automotive Attachment Tape (#06380, which has a white backing; or #06379, which has a black backing) or equivalent to the molding.
5. Align molding to tape guideline and press firmly in place.

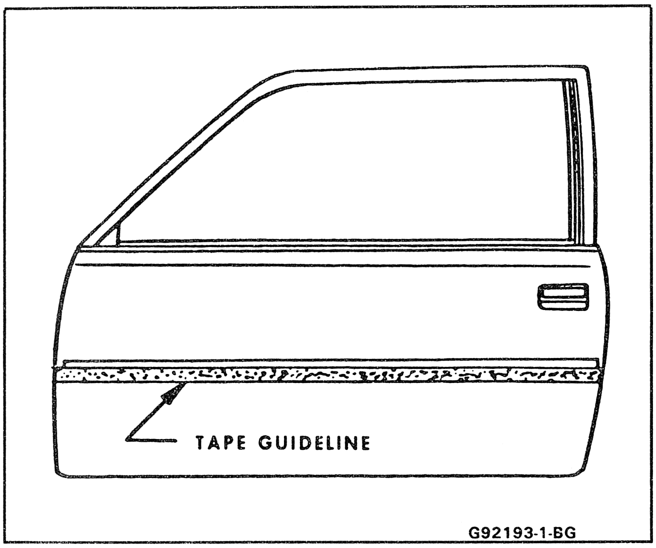


Figure 3 Adhesive Body Side Molding Repair

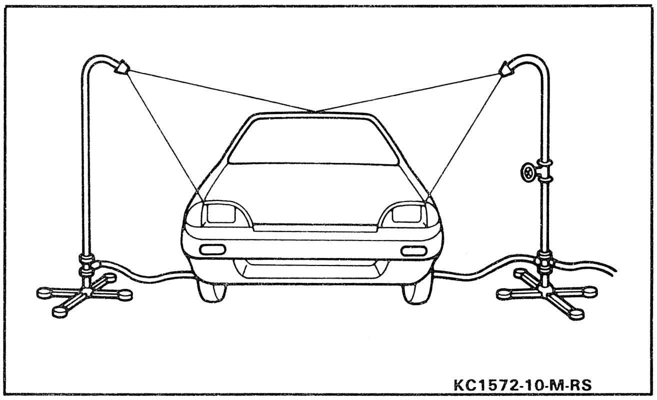


Figure 4 Watertest Stands Positioned For Front End Watertest

WATER LEAK DIAGNOSIS AND REPAIR

GM vehicles are designed to operate under normal environmental conditions. The design criteria for sealing materials and components takes into consideration the sealing forces required to withstand the natural elements. These specifications do not, and cannot, take into consideration all artificial conditions (i.e., high pressure car washes).

The water test procedure has been correlated to the natural elements and will determine the ability of a car to perform under normal operating conditions.

Repairing body water leaks is a problem of proper testing, diagnosis, and repair through adjustment of misaligned components and/or application of proven repair materials. The first step in water leak diagnosis is finding the conditions under which the leak occurs (for example, leak noticed only when parked on an inclined drive or water in spare tire compartment).

If the general leak area can be found, the exact entry point can be quickly isolated by use of a localized test such as a water hose or air hose. If the leak source is not obvious, the generalized testing method using water test equipment such as the water test stands shown in Figure 4 should be used. It may be necessary to remove some interior trim panels or components to locate and confirm repairs.

GENERALIZED TESTING

Specifications for construction of the water test stand are shown in Figure 5.

If the specified water pressure of 155 kPa (22 psi) cannot be obtained because of a local situation, both test stands may be moved toward body until water spray overlap can be obtained.

LOCALIZED TESTING (SPOT TEST)

Localized testing may be made with either water or air. Begin test at the base of the suspected area and continue up slowly until the leak is located.

Important

- Pinpoint the leak area before any repair is made. Random repair may only temporarily restrict water entry and make future diagnosis and repair more difficult.

Continue localized testing in the same general area to confirm that all leaks have been located.

WATER HOSE TEST

- Have an assistant inside the car to detect the actual leak point (Figures 6 and 7).
- Use unrestricted water flow (no nozzle).
- Begin at base of suspected leak area and move upward slowly.

AIR HOSE TEST

- Apply bubble solution (liquid soap) to suspected area (Figures 8 and 9).
- Apply air pressure with an air hose from inside the car. Do not exceed 205 kPa (30 psi).
- Observe for outside bubbles at suspected leak area.

WATER LEAK REPAIR

To locate the exact leak point or to repair the leak, it may be necessary to remove some interior trim panels or components. For waterleak repair procedure on stationary glass, see Section 10-2 (Figure 10).

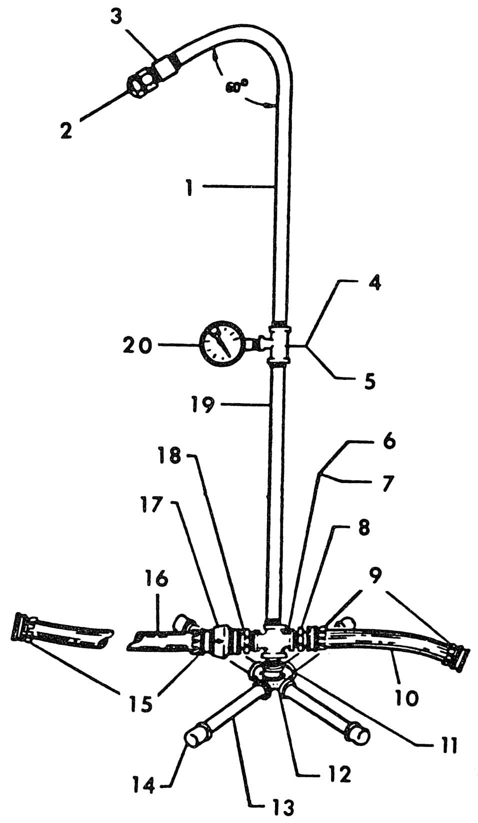
After completion of any water leak repair, the general area should be retested using the water test stand. Do not use air hose or water hose to test repaired areas as the repair material may dislodge under abnormal pressure.

ANTI-CORROSION TREATMENT

As rust proof treatment, steel sheets are given corrosion resistance on the interior and/or exterior. These corrosion resistant steel sheet materials are called one or two-side galvanized steel sheets. It is for the sake of rust protection that these materials are selected and given a variety of treatments as shown below.

1. Steel sheets are treated with cathodic electro-primer which is excellent in corrosion resistance.
2. Rust proof wax coatings are applied to the door and side sill insides where moisture is liable to stay.
3. Vinyl coating is applied to the body underside and wheel housing inside.
4. Chip resistant material is applied to the side sill, front skirt and rear skirt outside bottom areas to protect the painted surface from the damage due to flying stones.
5. Sealer is applied to the door hem, engine compartment steel sheet-to-steel joint, and the like portions to prevent water penetration resulting in rust occurence.

It is the essential function of any repair operation to correctly recoat the related surfaces of the relevant area.



1. 1/2" x 36" Pipe
2. Full-Jet Spray Nozzle #1/2GG-25 or Equivalent Nozzle Height - 64" to Floor
3. 1/2" Coupling
4. 1/2" x 1/2" x 1/4" Reducing Tee (Right Only)
5. 1/2" Coupling (Left Only)
6. 1/2" Cross (Right Only)
7. 1/2" Tee (Left Only)
8. 1/2" Pipe to Hose Nipple (Right Only)
9. 5/8" Female Hose Coupling
10. 2' Input Hose (5/8" Dia.) Right Only
11. 1/2" Close Nipple
12. 1/2" Cross with Weld-On 1/2" Cap
13. 1/2" x 12" Nipple
14. 1/2" Cap
15. 5/8" Female Hose Coupling
16. 12' Cross Hose (5/8" Dia.)
17. Hose Quick Connect
18. 1/2" Pipe to Hose Nipple
19. 1/2" x 30" Pipe (Straight)
20. Water Pressure Gage (Right Side)

G92387-1-BG

Figure 5 Watertest Stand

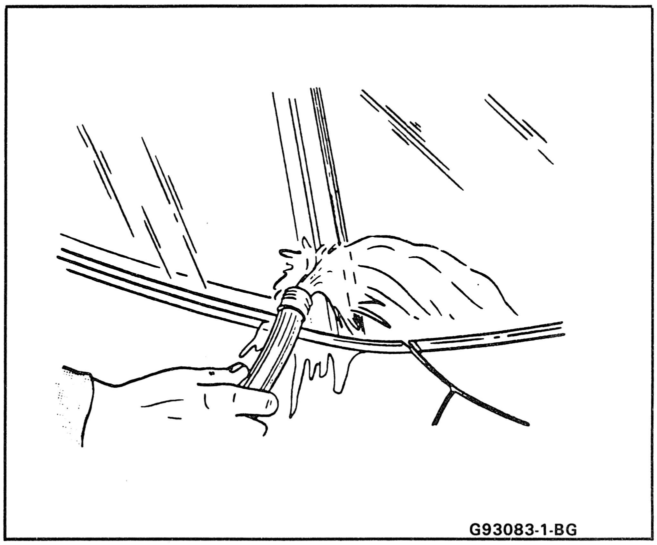


Figure 6 Water Hose Test of Windshield Pillar

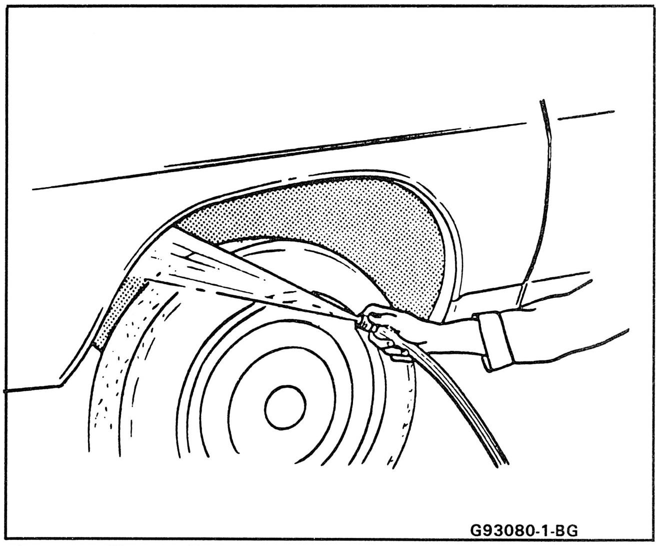


Figure 7 Pressure Test of Wheelbase

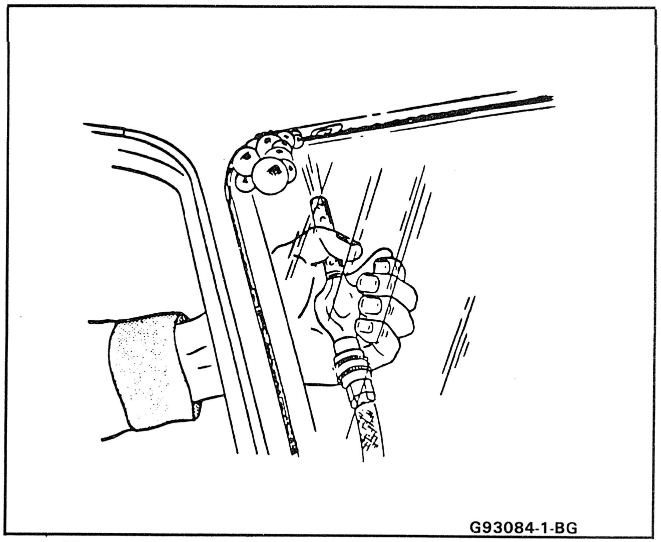


Figure 8 Air Hose and Bubble Solution Test of Windshield Glass Sealant

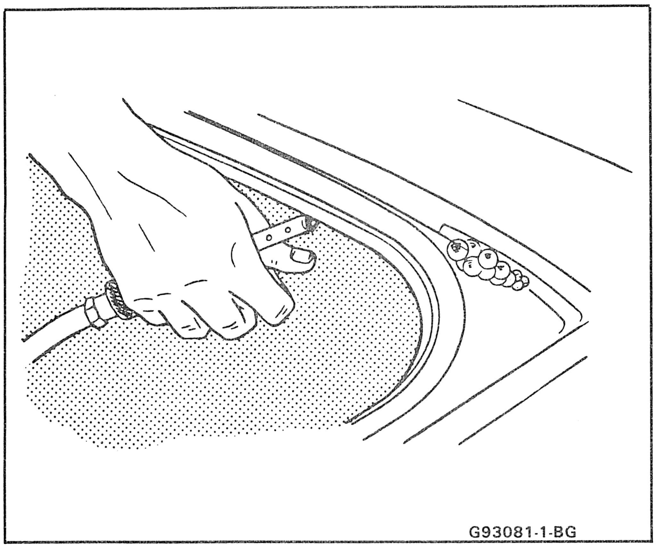
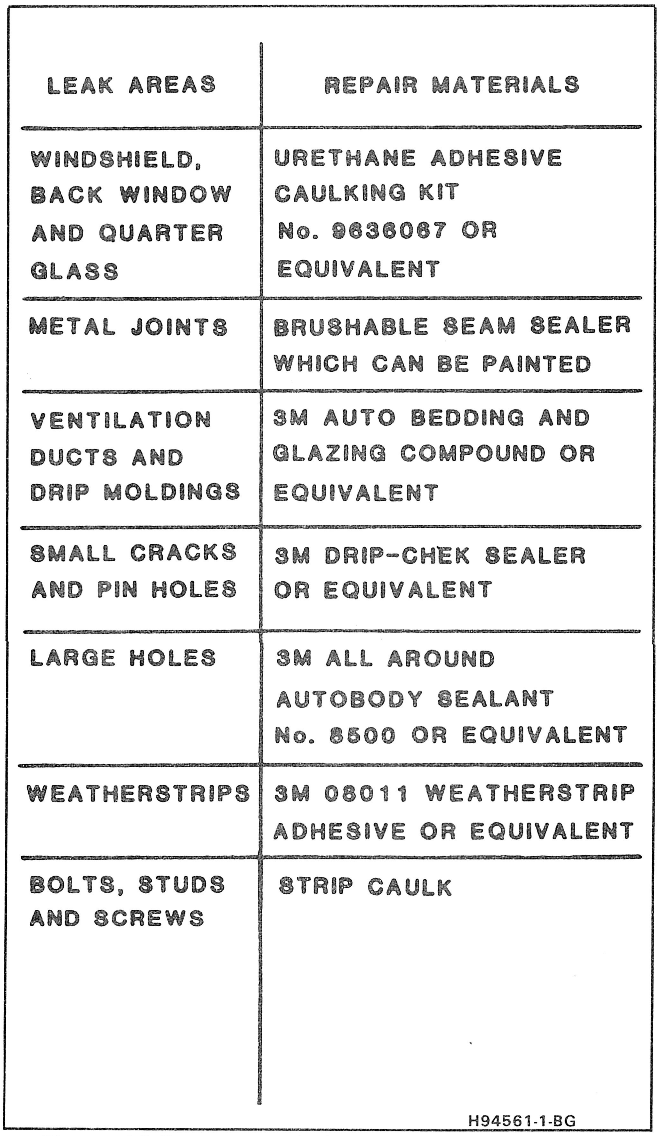


Figure 9 Air Gun and Bubble Solution Test of Panel Joints



LEAK AREAS	REPAIR MATERIALS
WINDSHIELD, BACK WINDOW AND QUARTER GLASS	URETHANE ADHESIVE CAULKING KIT No. 9636067 OR EQUIVALENT
METAL JOINTS	BRUSHABLE SEAM SEALER WHICH CAN BE PAINTED
VENTILATION DUCTS AND DRIP MOLDINGS	3M AUTO BEDDING AND GLAZING COMPOUND OR EQUIVALENT
SMALL CRACKS AND PIN HOLES	3M DRIP-CHEK SEALER OR EQUIVALENT
LARGE HOLES	3M ALL AROUND AUTOBODY SEALANT No. 8500 OR EQUIVALENT
WEATHERSTRIPS	3M 08011 WEATHERSTRIP ADHESIVE OR EQUIVALENT
BOLTS, STUDS AND SCREWS	STRIP CAULK

Figure 10 Recommended Materials for Waterleak Repair

All the metal panels are coated with metal conditioners and primer coating during vehicle production. Following the repair and/or replacement parts installation, every accessible bare metal surface should be cleaned and coated with rustproof primer.

Perform this operation prior to the application of sealer, rustproof wax coating, and chip resistant material.

Sealer is applied to the specific joints of a vehicle during production. The sealer in intended to prevent dust from entering the vehicle and serves also as an anti-corrosive barrier. The sealer is applied to the door and hood hem areas and between panels. Correct and reseal the originally-sealed joints if damaged. Reseal the attaching joints of a new replacement panel and reseal the hem area of a replacement door or hood.

Use a quality sealer to seal the flanged joints, overlap joints, and seams. The sealer must have flexible characteristics and paintablity after it is applied to repair areas.

For the sealer to fill open joints, use caulking material. Select a sealer in conformance with the place and purpose of a specific use. Observe the manufacturer's label-stated instructions when using the sealer.

In many cases, repaired places require color painting. When this is required, follow the ordinary techniques specified for the finish preparation, color painting, and undercoating build-up.

Rustproof wax, a penetrative compound, is applied to the metal-to-metal surfaces (door and side sill insides) where it is difficult to use ordinary undercoating material for coating. Therefore, when selecting the rustproof wax, it should be the penetrative type.

During the undercoating (vinyl coating) application, care should be taken that sealer is not applied to the engine-related parts and shock absorber mounting or rotating parts. Following the undercoating, make sure that body drain holes are kept open.

The sequence of the application steps of the anti-corrosive materials are as follows:

1. Clean and prepare the metal surface.
2. Apply primer.
3. Apply sealer (all joints sealed originally).
4. Apply color in areas where color is required such as hem flanges, exposed joints, and under body components.
5. Apply anti-corrosive compound (penetrative wax).
6. Apply chip-resistant material.
7. Apply undercoating (rustproof material).

When the welding or heating operation causes the original galvanization or other anti-corrosive materials to be burnt, the interior and underbody panel surfaces must be cleaned.

Removal of residues of the burning should be carried out carefully when the relevant place has box-type construction or has a shape which limits the access to the interior surfaces. In general, the following method can be used satisfactorily for the removal of those residues.

CAUTION: Standard shop practices, particularly eye protection, should be followed during these operations to avoid personal injury.

- Scraping can be used where access is possible. If a standard putty knife or scraper will not fit into the affected area, consider fabricating a small flexible scraper from a narrow piece of sheet metal.
- A jet of compressed air will remove most residue and could be most effective in limited-access areas. Eye protection is absolutely necessary in an operation of this type.
- Sandblasting is most effective and should be used when the equipment is available and access to the area is good. Sandblasting is an excellent method for clean-up and preparation of open joints, underbody components, and hem flange areas.
- Wire brushing (power and by hand).
- Sandpaper and steel wool can be used when access is good.

PAINT CONDITIONS AND REPAIRS

PLASTIC PARTS FINISHING

Paintable plastic parts are ABS plastic parts. ABS plastic is used for the front grille and headlamp cover.

Painting

Rigid or hard ABS plastic needs no primer coating.

General acrylic lacquers can be painted properly over the hard ABS plastic in terms of adherence.

1. Use cleaning solvent to wash paint finish.
2. Apply conventional acrylic color lacquer to the part surface.
3. Follow the lacquer directions for the required drying time. (As for the drying temperature, a range 60°F to 70°F is proper.)

Reference

Plastic parts employ not only ABS (Acrylonitrile Butadiene Styrene) plastic but also polypropyrene, vinyl, or the like plastic. Burning test method to identify the ABS plastic is described below.

1. Use a sharp blade to cut off a plastic sliver from the part at its hidden backside.
2. Hold sliver with pincers and set it on fire.
3. Carefully observe the condition of the burning plastic.
4. ABS plastic raises distinquishable black smoke while burning with its residue suspended in air temporarily.
5. Polypropyrene raises no readily distinquishable smoke while burning.

METAL REPLACEMENT PARTS FINISHING

Metal service replacement parts (or assemblies) are coated with electro-deposition primer. For proper adhesion of a paint, the following finish process (refinish steps) becomes necessary.

1. Use wax or grease-removing solvent to clean the part.
2. Use a wet or dry sandpaper (#400) to polish the panel lightly. Clean the part again.

3. If factory-applied primer coating is cut through to the bare metal, apply metal conditioner to the bare metal exposed to open air. As for the method of use of the metal conditioner, follow the directions on the container.
4. Allow primer-surfacer to dry completely before starting sandpaper polishing. As for the drying time, follow the directions advised on the primer-surface container.
5. Use a wet or dry sandpaper (#400) and water to polish the panel lightly.
6. Wash the part again.
7. Apply color coating to the part.
8. Different paints demand different drying methods. Hence, follow the directions advised on the pertinent paint container.
9. When the lacquer coating (quick-drying paint coating) is applied, dry the coated surface and polish it with compound.
10. In the case of the lacquer coating, wax should not be applied to the coated surface until the surface has dried completely (approximately two months).

- Before replacing the exterior parts or assemblies, check paint conditions of all the covered or hidden interior surfaces. If any rust scale is found at these places, proceed as follows:

1. Use a proper wire brush, adhesive or liquid rust removing agent to remove rust. As for the method of use, follow the directions advised for the respective materials.
2. If necessary, wash the parts with detergent, rinse, and dry them.
3. Before installing the exterior body parts, apply anti-corrosive compound to all the cleaned surfaces of the exterior body parts. Also, apply anti-corrosive compound to the inner surfaces of the exterior body parts to be installed.

INTERIOR PLASTIC TRIM PARTS FINISHING

Paintable plastic interior trim components can be divided into three general types:

- Polypropylene Plastic
- ABS Plastic
- Vinyl Plastic

It is important for a painter to be able to identify each plastic in order to paint it satisfactorily. Painting of complete soft seat cushion and seatback trim cover assemblies of vinyl construction is not approved by the factory. Excluding the soft seat cushion and seatback trim cover assemblies, the plastic used most widely on the interior of bodies is polypropylene.

The purpose of the following tests is to determine the identity of a given plastic so that proper paint procedures and materials can be used.

Test for Polypropylene and ABS Plastic

To determine if a service part to be painted is polypropylene or ABS plastic, perform the following burn test:

1. From a hidden backside portion of the part, remove a sliver of plastic with a sharp blade.
2. While holding the sliver of plastic with tweezers or laying it on a clean noncombustible surface, ignite the plastic.
3. Observe the burning plastic closely:
   a. Polypropylene burns with no readily visible smoke.
   b. ABS plastic burns with a readily visible black smoke residue which hangs temporarily in the air.

Test for Vinyl Plastic

To determine if a part to be painted is vinyl plastic (polyvinyl chloride), a copper wire test should be performed as follows:

1. Heat a copper wire in a suitable flame such as provided by a propane or equivalent torch until the wire glows red.
2. Touch the heated wire to the backside or hidden surface of the part being tested in a manner so as to retain some of the plastic on the wire.
3. Return the wire (and retained plastic) to the flame and observe for a green, turquoise blue flame. A flame in this color range indicates that the plastic being tested is vinyl.
4. If black smoke residue, which hangs temporarily in the air, is readily visible when wire (with retained plastic residue) is returned to the flame, the part is made of flexible (soft) ABS plastic material.

PAINTING POLYPROPYLENE PLASTIC PARTS

The system for painting polypropylene parts involves the use of a special primer. Since polypropylene plastic is hard, it can be color coated after prime with conventional interior acrylic lacquer.

NOTICE: Service part must be primed with a coating of special polypropylene primer according to factory recommendations. Failure to use the required primer as directed will result in color coat lifting and/or peeling problems. Use Polypropylene Primer, part #1052364, or equivalent.

1. Wash part with a solvent such as Acryli-Clean, Pre-Kleano, Prep-Sol, or equivalent. Follow label directions.
2. Apply a thin, wet coat of polypropylene primer according to label directions. Wetness of primer is determined by observing gloss reflection of spray application in adequate lighting. Be sure primer application includes all edges. Allow primer to flash dry one minute minimum and ten minutes maximum.
3. During the above flash time period (1 to 10 minutes), apply conventional interior acrylic lacquer color as required and allow to dry before installing part. Application of color during above flash time range promotes best adhesion of color coats.

PAINTING RIGID OR HARD ABS PLASTIC PARTS

Rigid or hard ABS plastic requires no primer. Conventional interior acrylic lacquers adhere satisfactorily to hard ABS plastics.

1. Wash part with a solvent such as Acryli-Clean, Pre-Kleano, Prep-Sol, or equivalent.
2. Apply conventional interior acrylic lacquer color according to trim combination (see paint supplier color chart for trim and color code). Apply only enough color for proper hiding to avoid washout of "grain" effect.
3. Allow to dry following label directions and then install part.

PAINTING VINYL AND FLEXIBLE (SOFT) ABS PLASTIC PARTS

The outer cover material of flexible instrument panel cover assemblies is made mostly of ABS plastic modified with PVC or vinyl. The same is true of many padded door trim assemblies. The soft cushion padding under ABS covers is urethane foam plastic.

The most widely used flexible vinyls (polyvinyl chloride) are coated fabrics as used in seat trim, some door trim assemblies, headlinings, and sunshades. Most head restraints are covered with flexible vinyls. Examples of hard vinyls are door and front seatback assist handles, coat hooks, and exterior molding inserts.

The paint system for vinyl and flexible ABS plastic involves the use of interior vinyl color and a clear vinyl top coat. No primer or primer-sealer is required.

1. Wash part with a vinyl cleaning and preparation solvent, such as Vinyl Prep, Vinyl Prep Conditioner, or equivalent. Wipe off cleaner while still wet with clean, lint-free cloth.
2. As soon as the surface has been wiped dry, apply interior vinyl color in wet coats. Allow flash time between coats. Follow label directions. Use proper vinyl color as shown by interior trim code combination. Apply only enough color for proper hiding to avoid washout of grain effect.
3. Before color flashes completely, apply one wet double coat of vinyl clear top coat. Use top coat with appropriate gloss level to match adjacent similar components. The clear coat is necessary to control the gloss requirement and to prevent cracking (rubbing-off) of the color coat after drying.
4. Allow to dry according to label directions before installing part.

AVAILABILITY OF COLORS FOR PAINTING INTERIOR PLASTIC PARTS

Interior colors are color keyed to trim code combination numbers located on the body number plate or service parts identification label.

Conventional interior acrylic lacquer colors are designed for use only on hard trim parts, such as:

1. Steel parts (primer and/or sealer required on new service parts).
2. Hard ABS plastic (no primer necessary).
3. Hard polypropylene plastic (special primer required).

Each major paint supplier provides an interior color chart which identifies the stock number, color name, gloss factor, and trim code combination number for each conventional interior color.

Vinyl interior colors are designed for soft trim parts such as instrument panel cover assemblies, door trim assemblies, and head restraints. These colors require a final top coat. Other trim parts require a degree of gloss to match similar adjacent parts. Use interior vinyl colors and clear vinyl finishes such as Ditzler Vinyl Spray Colors, American Jetway UR-1 Vynicolor, or equivalents.

SECTION 10-2

STATIONARY GLASS

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REMOVAL OF MINOR SCRATCHES AND ABRASIONS

Minor glass scratches and abrasions on the outside surface of the glass can be removed or reduced using the methods described in this section.

There are 2 basic types of auto glass: laminated safety plate (used in all windshields) and solid tempered safety plate (used in all side and back windows).

A major concern in the removal of scratches from glass is the chance of causing double vision in areas of occupant's vision. For this reason, removal of scratches or abrasions on a windshield in the occupant's line of vision is more limited than in other areas. Distortion is most apt to result when trying to remove deep scratches. Scratch removal must be performed with care.

- Low speed (600-1300 RPM) rotary polisher (Skil Model No. 570 or equivalent).
- Wool felt rotary-type polishing pad, about 75 mm (3 in.) in diameter and 50 mm (2 in.) thick.
- Powdered cerium oxide (No. 14 Rareox or equivalent) mixed with water as the abrasive compound. Follow manufacturer's directions when using any type of polishing compound.
- Wide mouth container to hold the polish.

NOTICE: This operation must not be used on the inside of rear window glass which contains heating elements that will be damaged.

1. Mix 2 parts of polishing compound (No. 14 Rareox or equivalent) with 1 part water to obtain a creamy mixture.
2. Stir mixture to maintain a creamy texture. Powdered cerium oxide is hard to mix with water and tends to separate.
3. Draw a circle around scratches on opposite side of glass with a wax marking pencil or crayon. Draw other lines directly behind scratches to serve as guides in locating scratch during polishing.
4. Use masking paper where needed to catch drippings or spattered polish.
5. Dip felt pad attached to polisher into mixture several times to ensure that pad is well saturated.

   NOTICE: Do not submerge or allow pad to stay in mixture as it may loosen bond between pad and metal plate.

6. Using moderate, but steady pressure, hold pad flat against scratched area of glass and, with a feathering-out motion, polish affected area (Figure 1). Avoid heavy pressure. It does not speed up operation and may cause overheating of glass.
7. Cover enough area around scratch with a feathering-out motion to eliminate a bull's-eye. Do not hold tool in one spot or operate tool on the glass any longer than 30 to 45 seconds at a time. If glass becomes hot to touch, let it air cool before proceeding further. Cooling with cold water may crack heated glass.
8. Dip pad into mixture frequently to ensure that wheel and glass are always wet during polishing operation. A dry pad causes too much heat to build up.
9. After removing scratch or abrasion, wash glass with water and wipe body clean of any polish.
10. Clean polishing pad.

WINDSHIELD AND BACK GLASS REVEAL MOLDINGS

The upper reveal molding for the windshield is a vinyl trim that fills the cavity between the body and glass edge. The reveal molding is hand pressed into place and retained by urethane adhesive.

UPPER WINDSHIELD MOLDING

Figure 1

↔ Remove or Disconnect

1. With flat bladed tool, pry off top and side windshield molding.
2. Grasp molding by hand and slowly pull away from body.

Install or Connect

1. Apply clear primer from urethane kit (#96360667) to lower surface of molding.
2. Apply urethane to cavity between body and glass.
3. Starting from the center, hand press molding into place. Tape may be applied to help retain molding.

LOWER WINDSHIELD REVEAL MOLDING

The lower windshield reveal molding is attached by plastic stud caps.

Remove or Disconnect

1. Windshield wiper arms.
2. Windshield wiper hoses.
3. Plastic stud caps.
4. Lower windshield reveal molding.

Install or Connect

1. Lower reveal molding.
2. Plastic stud caps.
3. Windshield washer hoses and wiper arms.

BACK GLASS REVEAL MOLDING

Remove or Disconnect

1. If so equipped, remove wiper arm.
2. Pry back glass molding away from glass using a flat-bladed tool.
3. Grasp molding by hand and slowly pull from back glass.

Install or Connect

1. Apply clear primer from urethane kit (#63060667) to lower molding surface.
2. Apply urethane to cavity between body and glass.
3. Starting from the center, hand press molding into place.
4. Optional wiper arm.

STATIONARY GLASS

To replace a windshield or back glass installed with urethane requires either partial or complete replacement of the adhesive. Partial replacement of material is known as the short method. Complete replacement is known as the extended method.

The short method can be used when original adhesive left on window opening pinch weld flanges after glass removal can serve as a base for new glass. This method would apply in cases of cracked windshield or removal of windows that are still intact. The amount of adhesive left in the window opening can be controlled during glass removal.

The extended method is to be used when the original adhesive left in the window opening after glass removal cannot serve as a base for new glass. This method would be used in cases needing metal work or paint repair in the opening. In these cases, original material is removed and replaced with new material during window replacement.

ADHESIVE SERVICE KIT

Adhesive kit #9636067 (urethane adhesive) or equivalent contains some of the items needed to replace a urethane adhesive using the short method, or any adhesive installed glass, using the extended method.

Additional items required:

- Solvent for cleaning edge of glass (preferably alcohol).
- Household cartridge-type caulking gun.
- Commercial type razor knife (for cutting around edge of glass).
- Eyeleteer.
- Piano wire.
- Rubber sucker grip.

WINDSHIELD

The front windshield is installed by using a special type of urethane adhesive in conjunction with a primer. When replacing a window, it is important to use an adhesive which provides sufficient adhesion strength and to follow the proper procedure (Figure 1).

> **NOTICE:** Each adhesive has its own drying and setting time and must be handled and used according to specific procedures. Failure to follow these procedures could result in a poor glass-to-body bond. Be sure to read the adhesive instructions very carefully and observe each step of the procedure very closely.

SHORT METHOD - WINDSHIELD

Figures 2 through 15

Remove or Disconnect

1. Clean both sides of glass and surrounding areas.
2. Wiper arms.
3. Molding and molding joints by cutting with a knife.
4. Use tape to cover body surface around glass to prevent damage.
5. Rearview mirror, sun visors and front pillar trims.
6. Warm front section of roof lining. Then remove front side rib of roof lining from between front glass and body (Figure 2).
7. Drill hole with eyeleteer through adhesive and slip piano wire through it (Figure 3).
8. Cut adhesive all around front glass with piano wire (2 technicians required) (Figures 4 and 5).

> **NOTICE:** Keep piano wire as close to the glass as possible to avoid body damage.

9. Windshield.

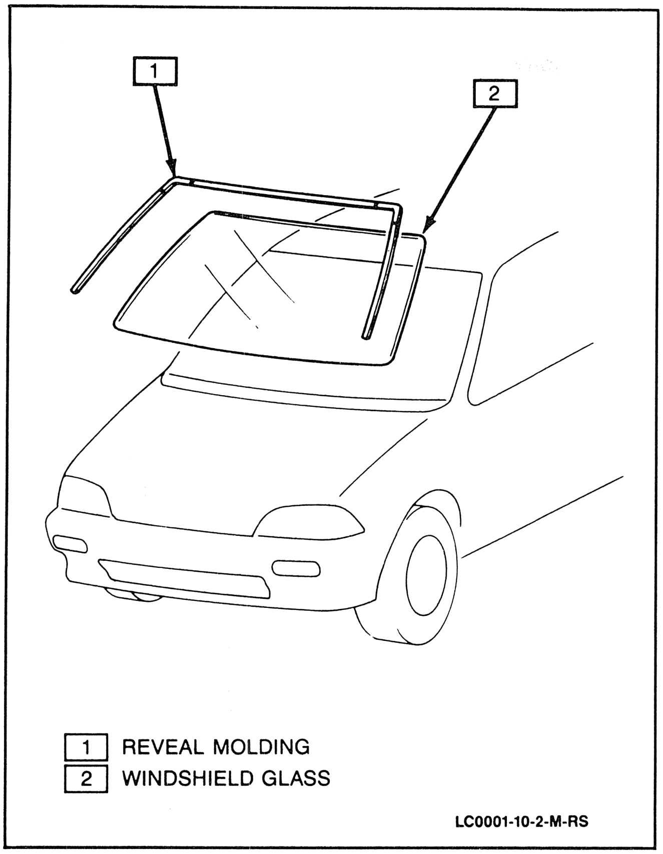


Figure 1 Front Windshield

10. Using a knife, smooth remaining adhesive around body side so that it is uniform in thickness-- 1-2 mm (Figure 6).

NOTICE: Before using knife, clean it with alcohol or a petroleum distillate to remove any dirt or oil from it.

11. If glass is to be re-used, remove adhesive from glass; use care not to damage the primer coated surface (Figure 7).

→← Install or Connect

1. Interior trim.

Clean

- Windshield edge using a cleaning solvent. Let dry for 10 minutes.
- Molding surface "A" with a clean cloth (Figure 8).

2. Spacers to lower side of windshield.
3. Upper molding to glass. Warming molding for 1/2-hour at 35° C (95° F) will facilitate work.
4. Windshield to body. Position glass so that clearance between upper end of glass and body is about 6 mm (0.236-inch) and clearances between each side of glass and body are even.

- Using a wax pencil, mark mating points on glass and body.
- Remove glass.

5. Primer to body surface where windshield is to be adhered using a new brush (Figure 10).
6. Side moldings to glass.
7. Primer to edge of windshield using same new brush.
8. Primer for molding (Urethane) to surface "A" using a new brush (Figure 8).

Important

- Refer to manufacturer's instructions for proper handling instructions and drying time.
- Do not touch primer coated surface.

9. Adhesive to glass (Figure 18).

Important

- Apply adhesive starting from bottom side of glass.
- Be careful not to damage primer.
- Height of adhesive applied to lower side should be higher than that of other 3 sides.
- Press glass against body quickly after adhesive is applied.
- Use of rubber sucker grips is helpful to hold and carry glass after adhesive is applied.

- Peel remaining paper from rubber dam.

10. Windshield to body using rubber sucker grips. Align glass to body using mating marks drawn earlier.

Inspect

- Vehicle for water leaks by running water from hose over windshield. If leakage is found, dry window and fill leaky point with adhesive. If water still leaks at this point, remove glass and repeat installation procedure.

Important

- Do not use high pressure water.
- Do not apply compressed air to parts with adhesive while drying.
- Do not use infrared lamp or similar device for drying.
- Sudden closing of door before adhesive is completely set may cause glass to loosen or come off. If door is opened or closed before adhesive is completely set, make sure to open all door glasses and use proper care.
- If molding is not securely in place, hold it down with tape until adhesive is completely set.
- Each adhesive has its own setting time. Refer to manufacturer's instructions for setting time and any precautions to be taken before adhesive is set.
- Refrain from driving vehicle until adhesive is completely set to ensure proper adhesion.

REAR DOOR GLASS

The back door glass is installed by using a special type of urethane in conjunction with a primer. When

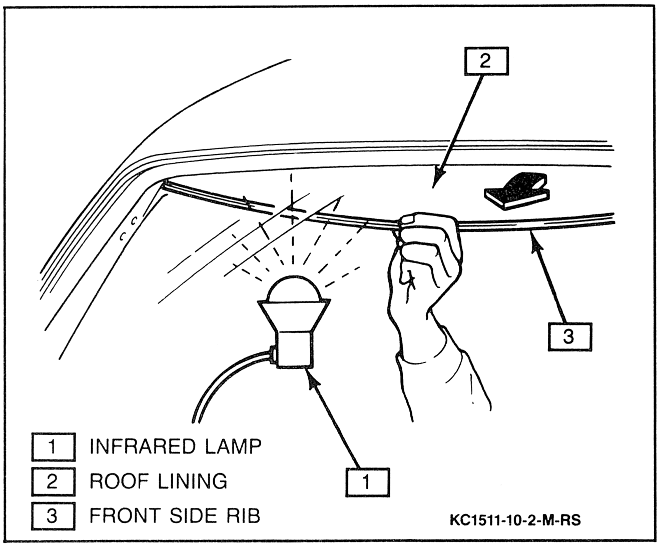

2
3
1
1 INFRARED LAMP
2 ROOF LINING
3 FRONT SIDE RIB
KC1511-10-2-M-RS

Figure 2 Front Roof Lining

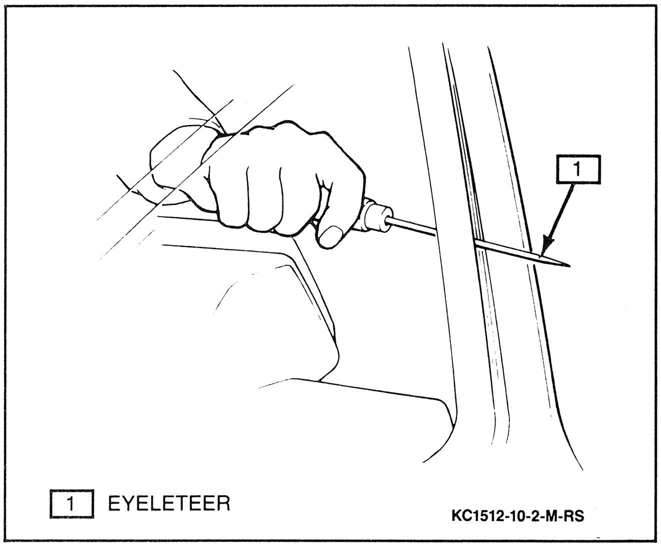

1
1 EYELETEER
KC1512-10-2-M-RS

Figure 3 Eyeleteer

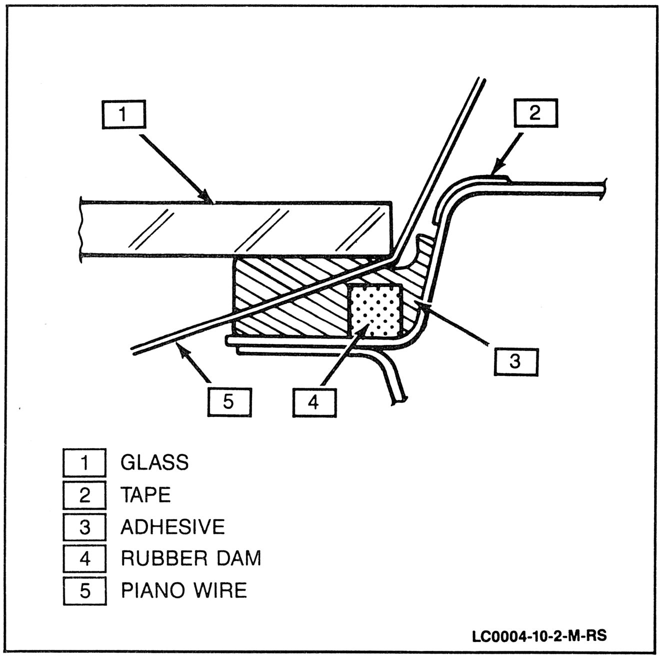

1
2
3
5
4
1 GLASS
2 TAPE
3 ADHESIVE
4 RUBBER DAM
5 PIANO WIRE
LC0004-10-2-M-RS

Figure 4 Piano Wire

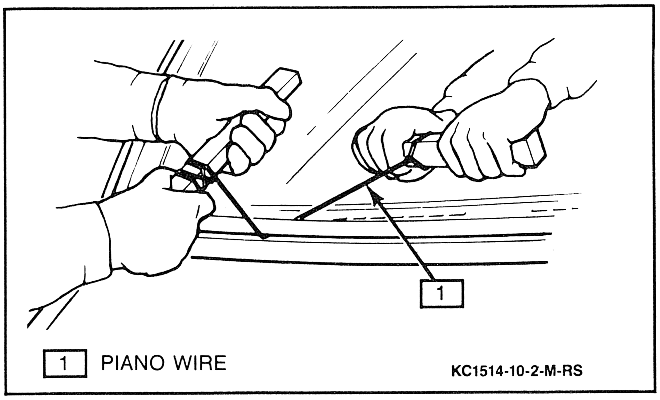

1
1 PIANO WIRE
KC1514-10-2-M-RS

Figure 5 Windshield Removal

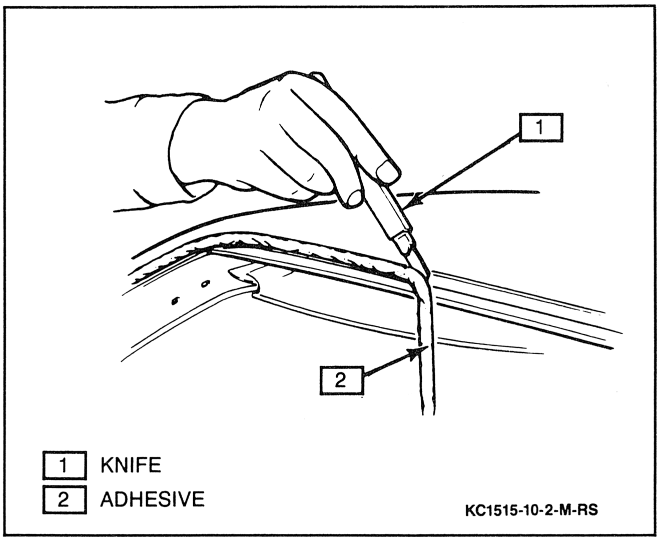

1
2
1 KNIFE
2 ADHESIVE
KC1515-10-2-M-RS

Figure 6 Shaping Old Adhesive

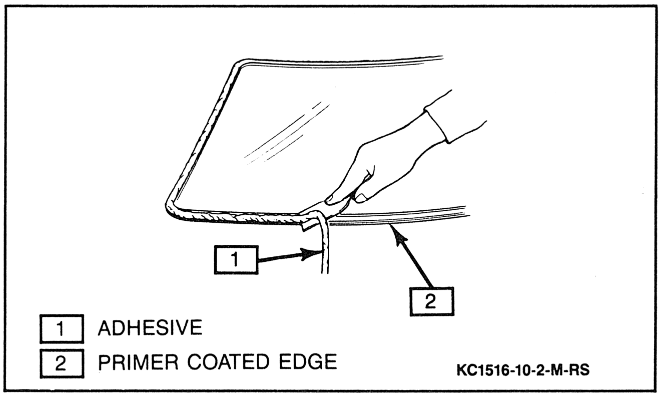

1
2
1 ADHESIVE
2 PRIMER COATED EDGE
KC1516-10-2-M-RS

Figure 7 Adhesive From Glass

replacing a window, it is important to use an adhesive which provides a sufficient adhesion strength and to follow the proper procedure.

NOTICE:

- Each adhesive has its own drying and setting time and must be handled and used according to specific procedures. Failure to follow these procedures could result in a poor glass-to-body bond. Be sure to read the adhesive instructions very carefully and to observe each step of the procedure very closely.

  Use an adhesive which has at least the following shearing strength: 40 km/cm_2 (569 lb./in_2.).

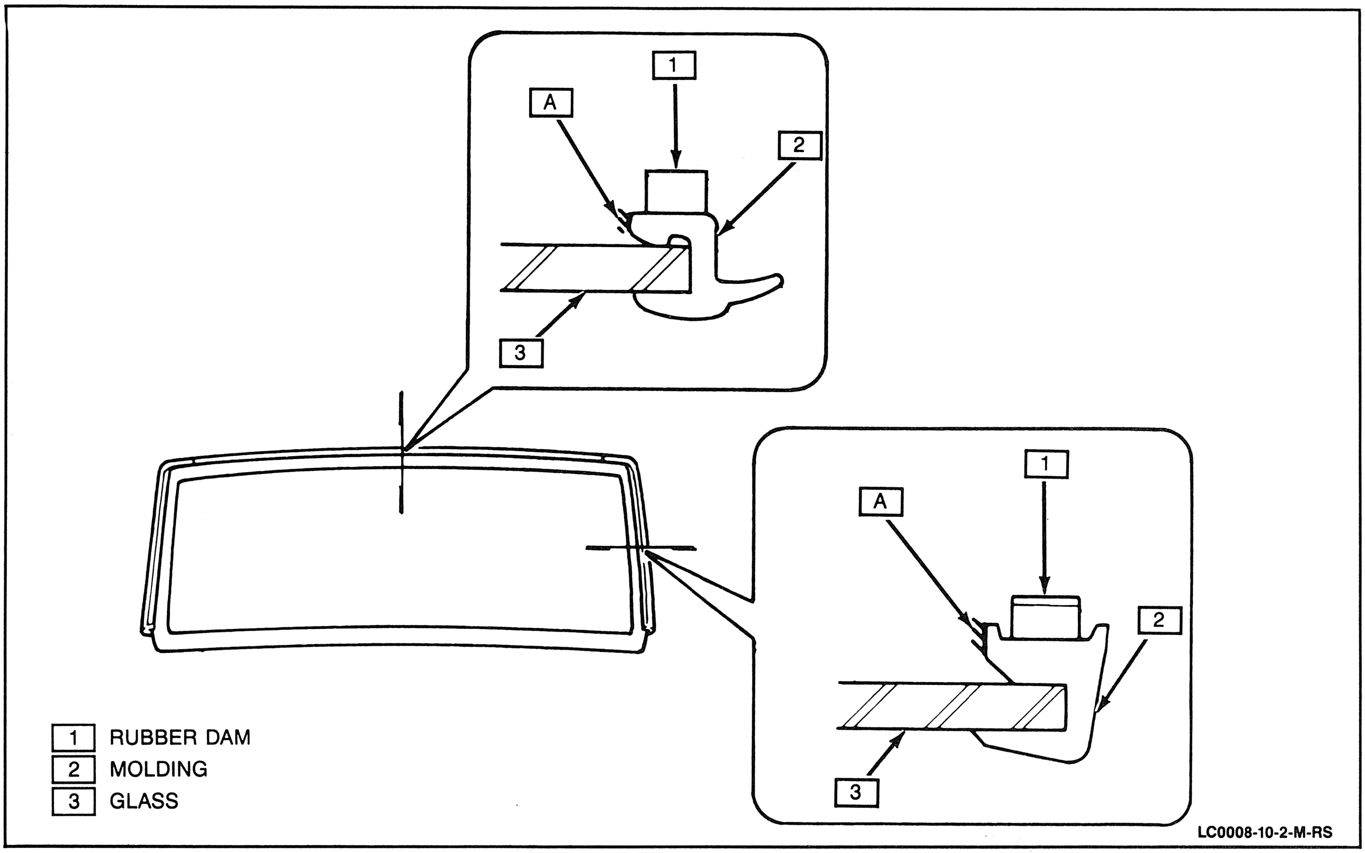


Figure 8 Application of Primer

Materials and Tools Required for Removal and Installation:

Figures 3 and 16 through 21

- Adhesive (410g/14.5 oz.).
- Primer for glass (20g/0.7 oz.).
- Primer for body (20g/0.7 oz.).
- Primer for molding (20g/0.7 oz.).
- Eyeleteer.
- Piano wire.
- Brush for body application.
- Knife.
- Rubber suction grip.
- Sealant gun (for filling adhesive).
- Putty knife.

↔ Remove or Disconnect

Clean

- Both sides of glass and the body around it.

1. Wiper arm if equipped.
2. Molding and molding joints by cutting with knife.
3. Cover body surface around back window with tape to prevent any damage.
4. Back door trim, rear wiper motor assembly and high-mounted stoplamp.
5. Drill hole through adhesive with eyeleteer (Figure 3) and slip piano wire through it.
6. Cut adhesive all around glass with piano wire.

NOTICE: Keep piano wire as close to glass as possible to avoid damage to the vehicle body.

7. Rear door glass.
8. Use a knife to smooth the remaining adhesive to a uniform thickness, about 1-2 mm all around the window opening.

NOTICE: Before using knife, clean with alcohol or a petroleum distillate to remove any dirt or oil.

9. When reusing glass, remove adhesive from glass; use care not to damage primer-coated surface.

→← Install or Connect

Clean

- Window edge with cleaning solvent. Allow to dry for 10 minutes.
- Glass surface with cleaning solvent. Allow to dry for 10 minutes.
- Molding surface "A" with a clean cloth (Figure 21).

1. New back door glass trim to window. (Don't peel paper off trim at this stage.)
2. Primer to body surface where window is to be adhered. Use a new brush.
3. Molding to glass. Don't peel paper off molding at this stage. Warming molding to 35° C (95° F) for 1/2-hour will facilitate work.
4. Primer to glass along surface to be adhered to window. Use a new brush.

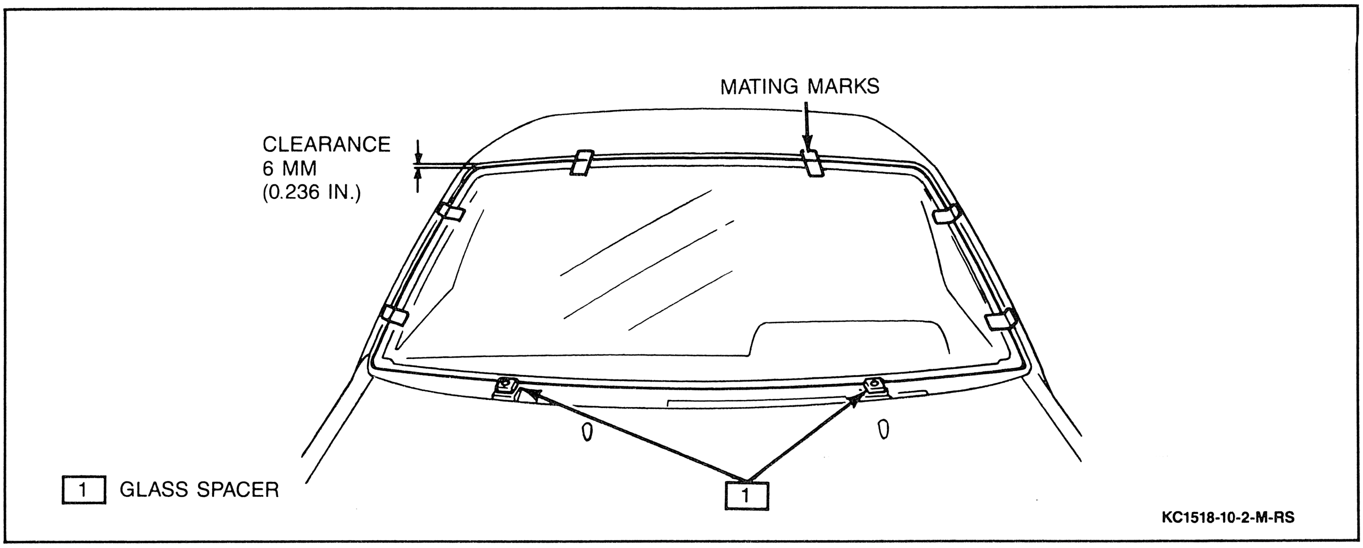


Figure 9 Windshield Spacing

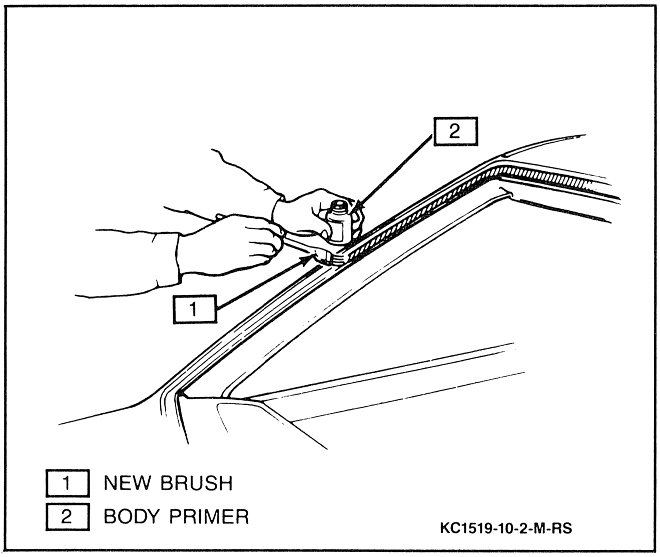


Figure 10 Primer to Body

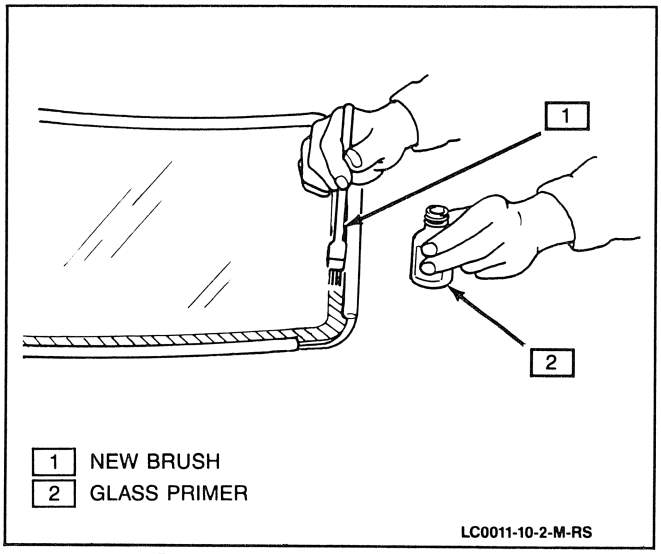


Figure 11 Windshield Molding

5. Primer for molding (Urethane) to surface "A." Use a new brush (Figure 21).

Important

- Refer to manufacturer's instructions for proper handling instructions and drying time.
- Do not touch primer coated surface.

6. Adhesive along upper and lower moldings.

Important

- Start from bottom side of glass.
- Height of applied adhesive should exceed that of trim and molding.
- Adhesive should be applied evenly especially in height.
- Be careful not to damage primer.
- Press glass against door quickly after adhesive is applied.
- Use of rubber sucker grips is helpful to hold and carry glass after adhesive is applied.

7. Peel paper from molding and window trim.
8. Holding rubber sucker grips, press glass against door so that clearance on left side and right side of glass is the same.

Inspect

- Vehicle for water leaks by running water from hose over windshield. if leakage is found, dry window and fill leaky point with adhesive. If water still leaks at this point, remove glass and repeat installation procedure.

Important

- Do not use high pressure water.
- Do not apply compressed air to parts with adhesive while drying.
- Do not use infrared lamp or similar for drying.
- Sudden closing of door before adhesive is completely set may cause glass to loosen or come off. If door is opened or closed before

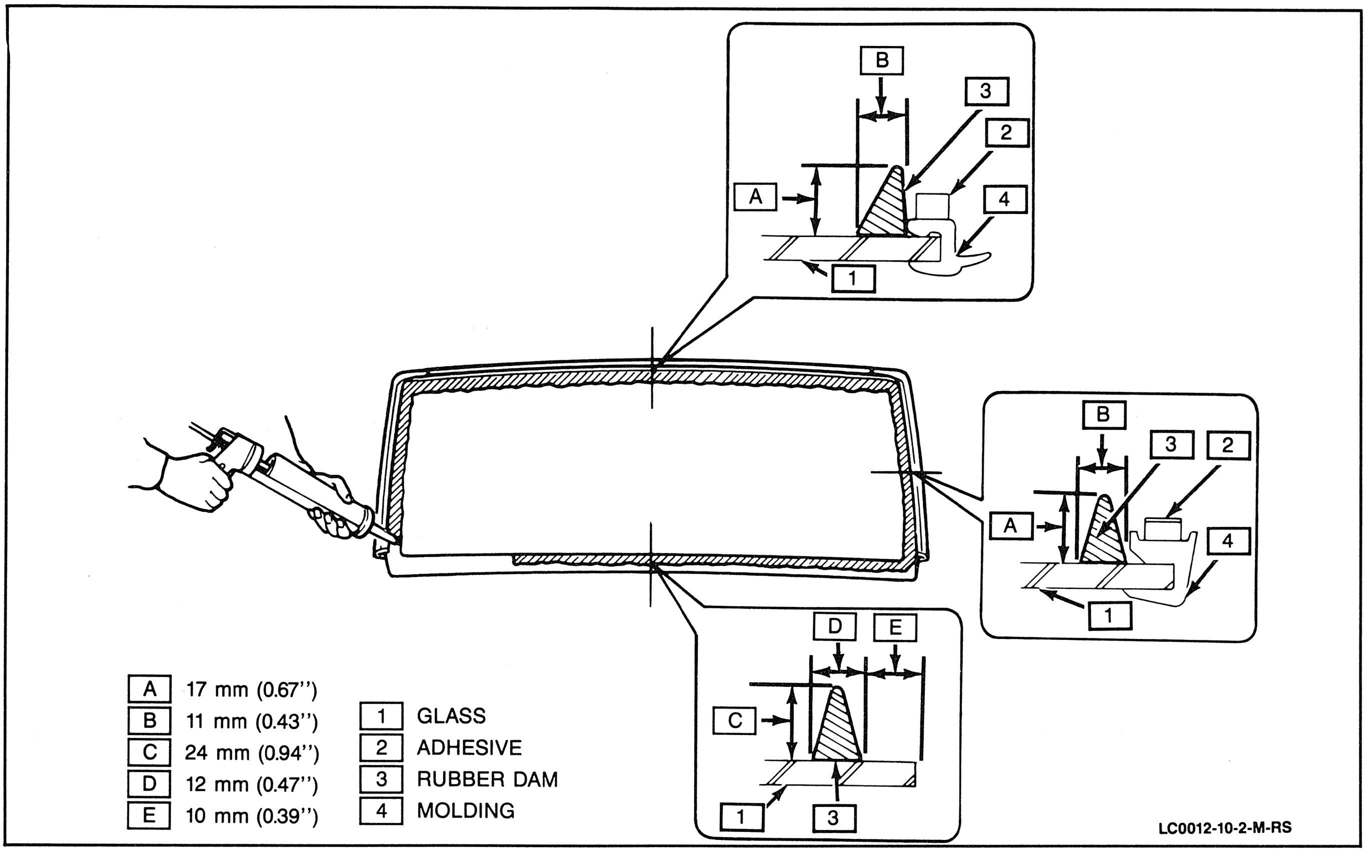

B
3
2
A
4
1
B
3
2
A
4
1
D
E
C
1
3
A 17 mm (0.67")
B 11 mm (0.43")
C 24 mm (0.94")
D 12 mm (0.47")
E 10 mm (0.39")
1 GLASS
2 ADHESIVE
3 RUBBER DAM
4 MOLDING
LC0012-10-2-M-RS

Figure 12 Application of Adhesive

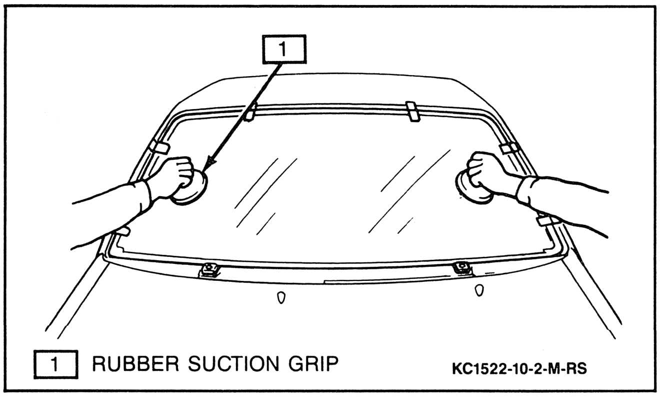

1
1 RUBBER SUCTION GRIP
KC1522-10-2-M-RS

Figure 13 Windshield Installation

adhesive is completely set, make sure to open all door glasses and use proper care.

- If molding is not securely in place, hold it down with tape until adhesive is completely set.
- Each adhesive has its own setting time. Refer to manufacturer's instructions for setting time and any precautions to be taken before adhesive is set.
- Refrain from driving vehicle until adhesive is completely set to ensure proper adhesion.

NOTICE: Be sure to refer to manufacturer's instructions and for proper handling and drying time.

9. After adhesive has set and glass is secure, install back door trim, rear wiper motor assembly and high-mounted stoplamp.

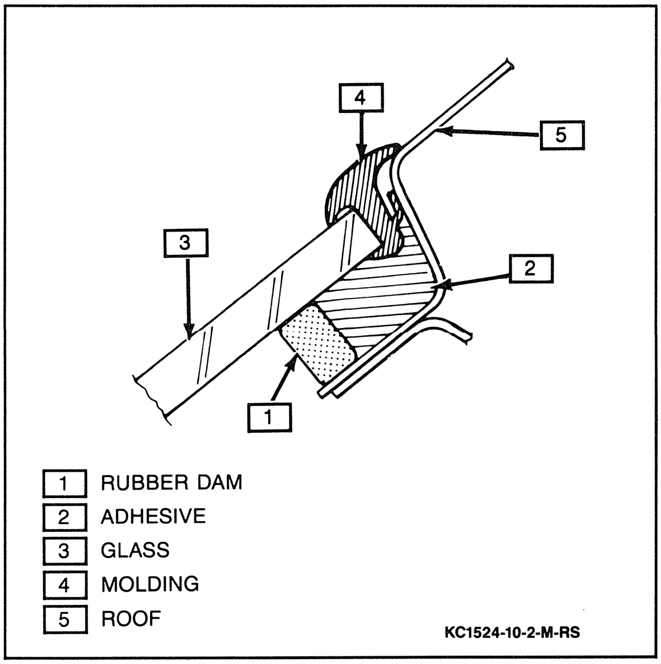

4
5
3
2
1
1 RUBBER DAM
2 ADHESIVE
3 GLASS
4 MOLDING
5 ROOF
KC1524-10-2-M-RS

Figure 14 Upper Windshield Attachment

QUARTER WINDOW ASSEMBLY

THREE DOOR MODEL

Figures 22, 23 and 24

↔ Remove or Disconnect

1. Quarter window lock (Figure 22).

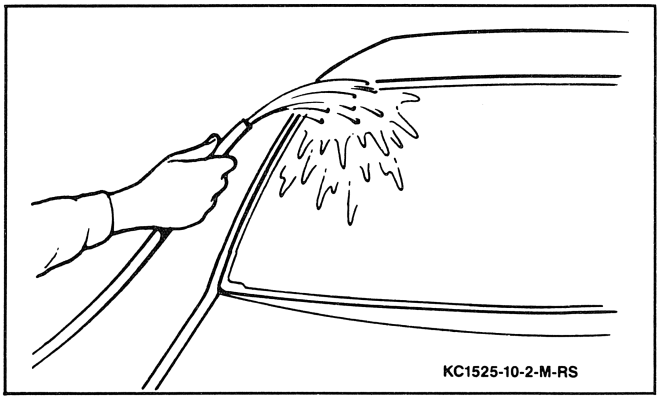


Figure 15 Check for Water Leaks

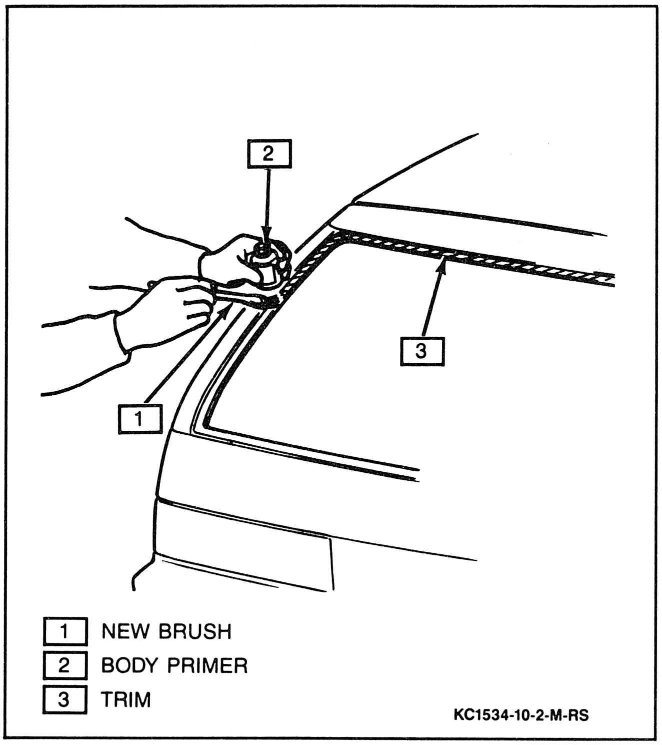


Figure 16 Primer to Body

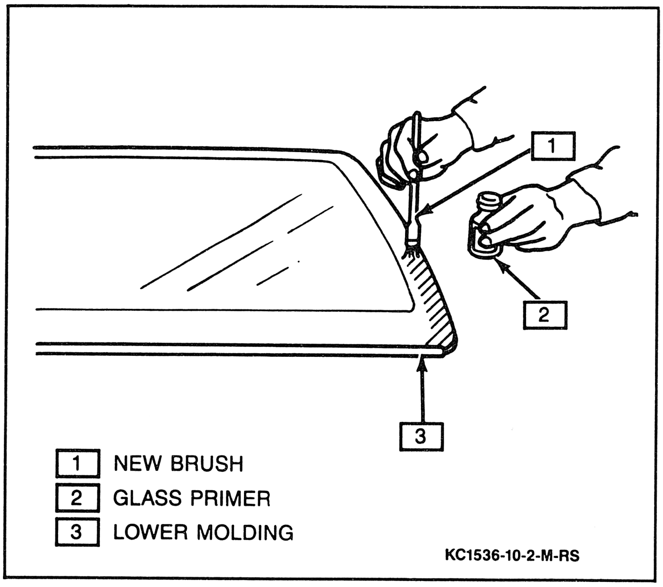


Figure 17 Primer to Glass

2. Hinge screws (Figure 24).

Install or Connect

1. Hinge screws.
2. Quarter window lock.

NOTICE: When replacing quarter window glass with a new one, be sure to use a new hinge protector as well (Figure 23).

FIVE DOOR MODEL

Figures 25 through 35

Unlike the three door model, the five door model's quarter windows do not open. The procedure for removal of the quarter window is very similar to the procedure for windshield or rear glass removal. The quarter window is bonded to the body using a special type of urethane adhesive in conjunction with a primer. When replacing a window, it is important to use an adhesive which provides sufficient adhesion strength and to follow the proper procedures.

NOTICE: Each adhesive has its own drying and setting time and must be handled and used according to specific procedures. Failure to follow these procedures could result in poor glass-to-body bond. Be sure to read the adhesive instructions carefully and observe each step of the procedure very closely.

Remove or Disconnect

1. Molding around quarter window with knife.
2. Use tape to cover body area around window opening to prevent potential damage.
3. Punch a hole through adhesive with eyeleteer and then slip piano wire through hole (Figure 26).
4. Cut adhesive all around quarter glass with piano wire (Figure 27).

NOTICE: Keep piano wire as close to glass as possible to prevent damage to body.

5. Quarter window.
6. Use a knife to smooth the remaining adhesive on body to a uniform thickness all around, about 2-3 mm (Figure 28).
7. Where rubber dam is to be placed, remove adhesive until painted surface is clean.
8. When re-using glass, remove adhesive from glass surface, taking care not to damage primer coating (Figure 39).

Install or Connect

Clean

- Using a cleaning solvent, clean window opening edge where window is to be placed; allow at least 10 minutes drying time.

1. Use a new brush to apply primer along the body surface where the glass will be bonded (Figure 30).

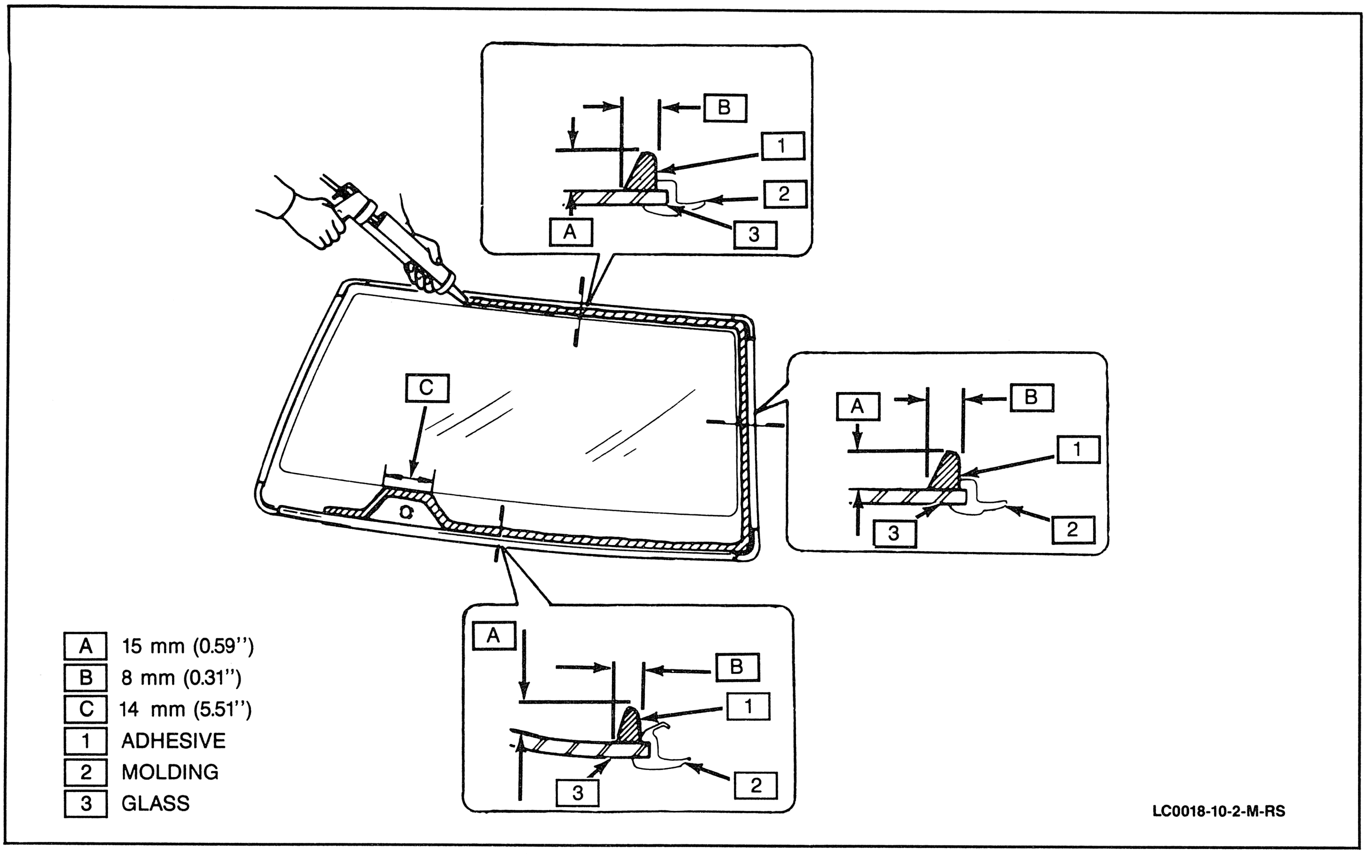

A
B
C
1
2
3
A 15 mm (0.59")
B 8 mm (0.31")
C 14 mm (5.51")
1 ADHESIVE
2 MOLDING
3 GLASS
LC0018-10-2-M-RS

Figure 18 Adhesive to Glass

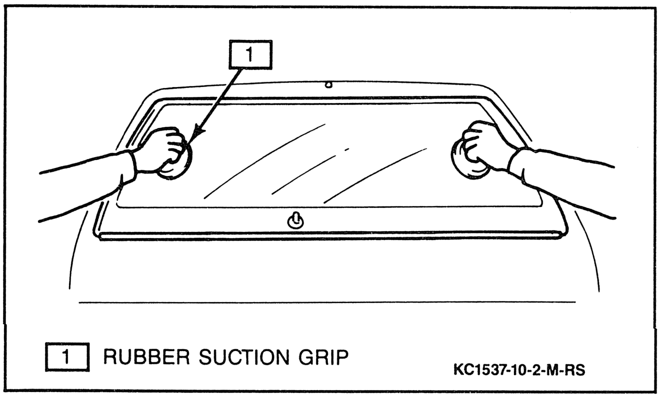

1
1 RUBBER SUCTION GRIP
KC1537-10-2-M-RS

Figure 19 Rear Glass Install

NOTICE: Follow manufacturer's instructions concerning primer application and drying time.

2. New molding onto glass (Figure 31).
3. Apply primer to window using new brush (Figure 32).

NOTICE: Do not touch primer-coated surface.

4. Apply adhesive as shown (Figure 33).
5. Peel remaining paper from rubber dam and molding.
6. Using a rubber suction grip, install glass. Press against body so that the clearances on the front and rear side on the window are equal (Figure 34).
7. Check for water leakage by pouring water over window. If a leak is found, dry window and fill leaky point with adhesive. If leak persists, remove glass and repeat entire installation procedure (Figure 35).

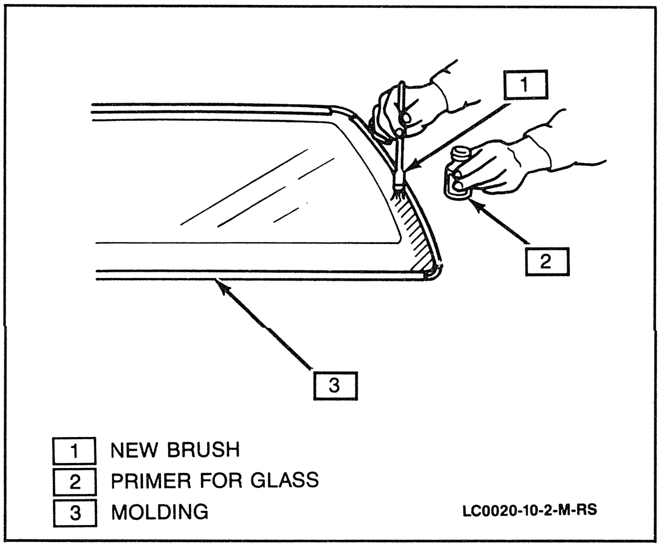

1
2
3
1 NEW BRUSH
2 PRIMER FOR GLASS
3 MOLDING
LC0020-10-2-M-RS

Figure 20 Primer to Glass

NOTICE:

- Do not use high pressure water.
- Allow adhesive to air dry normally--do not use compressed air or any type of heat lamp to shorten drying time.
- Slamming of the door could cause the adhesive to shift and the glass to set improperly. Take great care if doors must be opened or closed during the drying period.

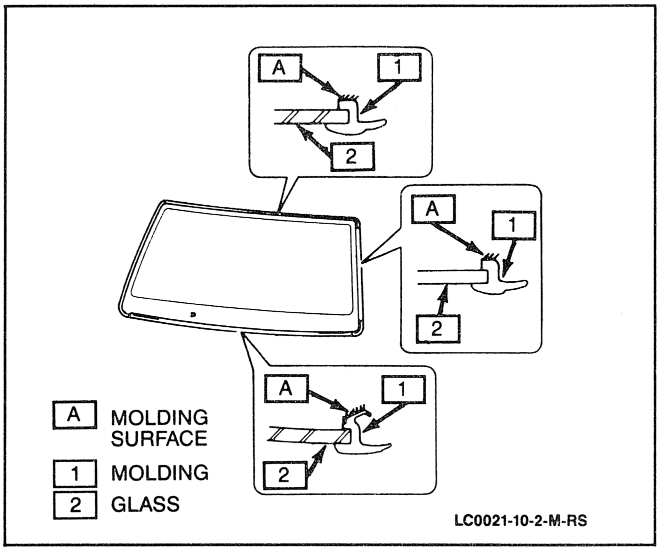


Figure 21 Application of Adhesive

- Do not drive vehicle for at least six hours after window has been installed.

WATER LEAK CORRECTION

Where accessible, water leaks can be corrected without removing and reinstalling the glass. This method applies only to urethane installed glass and the use of adhesive furnished in kit #9636067 or equivalent.

1. Remove reveal moldings in area of leak. In some cases, it may become necessary to remove garnish moldings or trim strip lace to locate source of leak.
2. Mark location of leak(s). Carefully push outward on glass in area of leak to determine extent of leak. This operation should be performed while water is being applied to leak area. Mark extent of leak area.

Clean

- From outside body, clean any dirt or foreign material from leak area with water, then dry area with air hose.

3. Using a sharp knife, trim off uneven edge of adhesive material at leak point and 75 mm (3 in.) to 100 mm (4 in.) on both sides of leak point or beyond limits of leak area.
4. Prime affected area, as shown in operation B with black primer supplied in kit. Agitate primer prior to use. Allow primer to dry five minutes.
5. Apply adhesive material at leak point and 75 mm (3 in.) to 100 mm (4 in.) on both sides of leak point or beyond leak point.
6. Immediately after performing step 5, use a flat stick or other suitable flat-bladed tool to work adhesive material well into leak point and into joint of original material and body to effect watertight seal along entire length of material application.
7. Using warm or hot water, spray test to ensure that leak has been corrected. Do not run heavy stream of water directly on freshly applied adhesive.
8. Replace all previously removed parts.

REARVIEW MIRROR

Remove or Disconnect

1. Pry off forward dome lamp cover plate.
2. Rubber mirror-to-window vibration damper.
3. Two inner cross-recess screws to detach mirror assembly.

Install or Connect

1. Mirror assembly with 2 cross-recess screws.

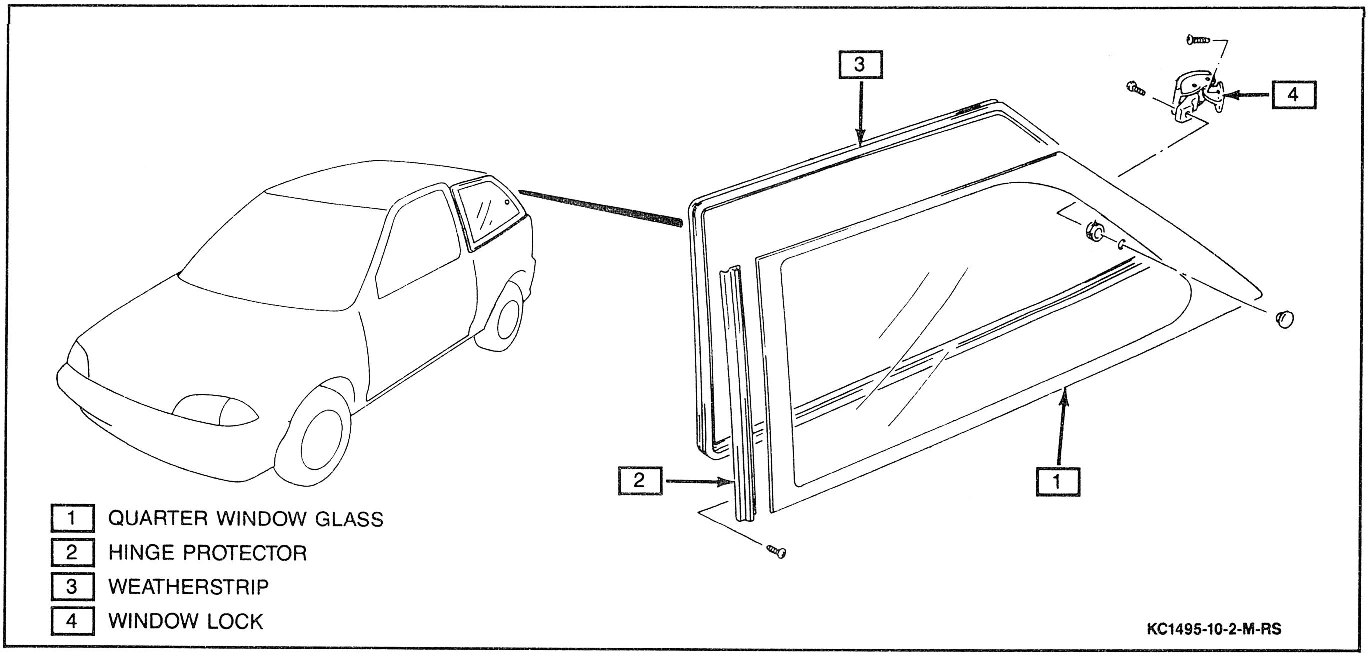


Figure 22 Quarter Window

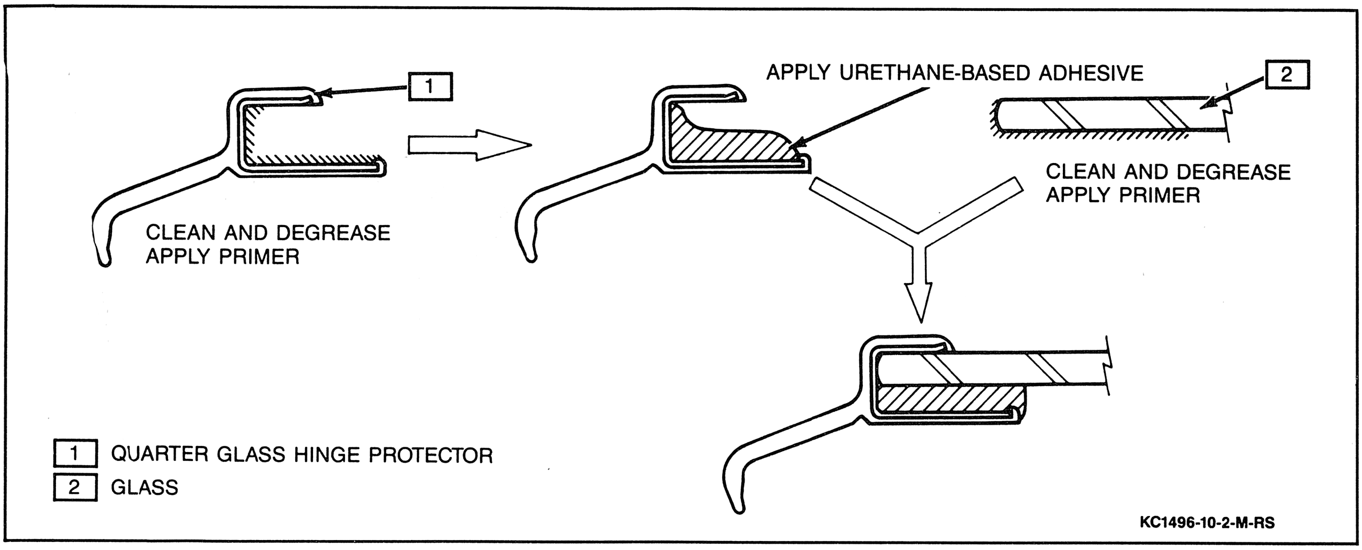

1
APPLY URETHANE-BASED ADHESIVE
2
CLEAN AND DEGREASE
APPLY PRIMER
CLEAN AND DEGREASE
APPLY PRIMER
1 QUARTER GLASS HINGE PROTECTOR
2 GLASS
KC1496-10-2-M-RS

Figure 24 Hinge Protector

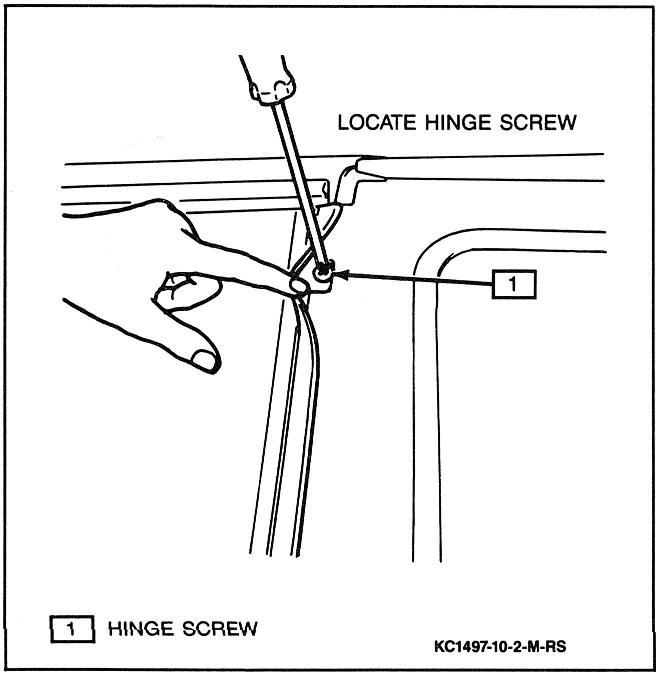

LOCATE HINGE SCREW
1
1 HINGE SCREW
KC1497-10-2-M-RS

Figure 23 Locate Hinge Screw

2. Rubber vibration damper to mirror assembly.
3. Forward dome lamp cover plate.

REAR WINDOW DEFOGGER

The optional rear window defogger system consists of a rear glass that has a number of horizontal ceramic silver compound element lines and 2 vertical buss bars on the inside surface of the rear glass. The feed wire or terminal is soldered to the buss bar on the side. The ground wire or terminal is soldered on the other side.

The system operates on 12 volts. Under some conditions, heat from the glass may not be detected by finger touch. The length of time required to remove interior fog from the back glass will vary with such conditions as car speed, outside glass temperature, atmospheric pressure and number of passengers.

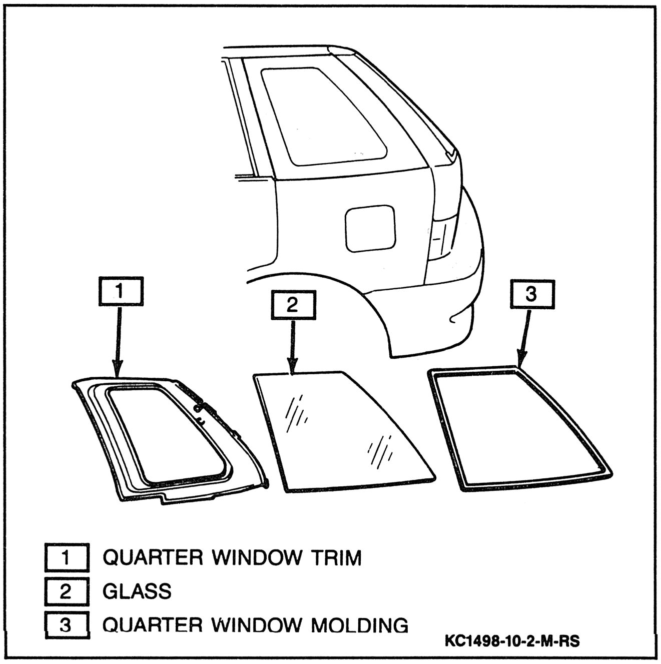

1
2
3
1 QUARTER WINDOW TRIM
2 GLASS
3 QUARTER WINDOW MOLDING
KC1498-10-2-M-RS

Figure 25 Quarter Window

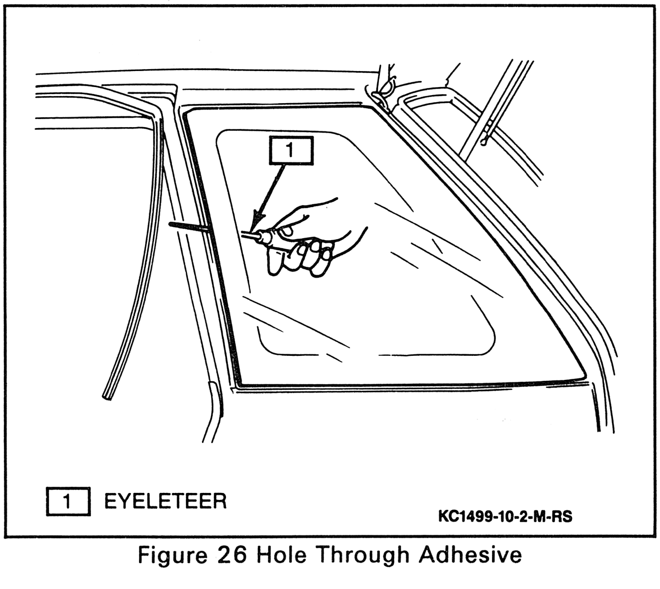

1
1 EYELETEER
KC1499-10-2-M-RS

Figure 26 Hole Through Adhesive

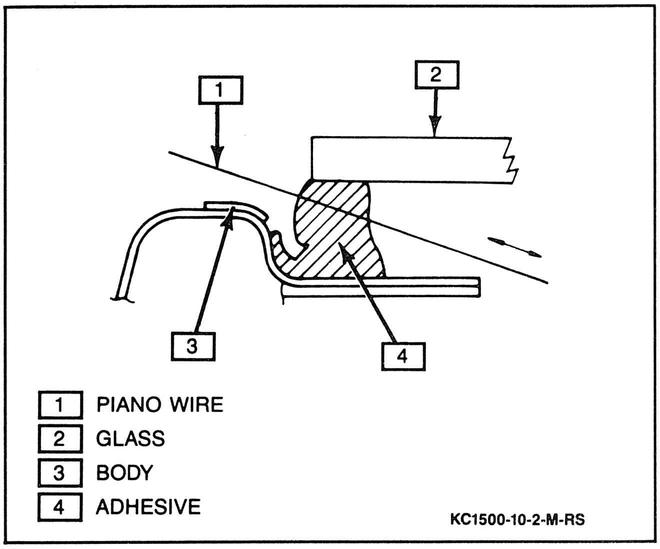

1
2
3
4
1 PIANO WIRE
2 GLASS
3 BODY
4 ADHESIVE
KC1500-10-2-M-RS

Figure 27 Cutting Adhesive

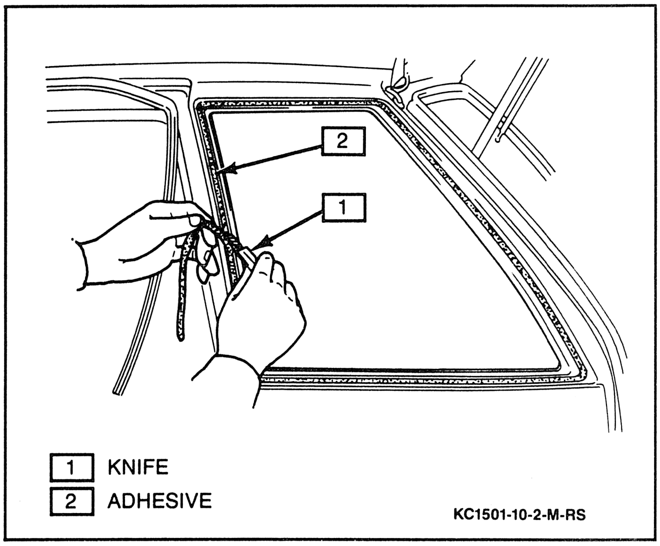

2
1
1 KNIFE
2 ADHESIVE
KC1501-10-2-M-RS

Figure 28 Smoothing Adhesive

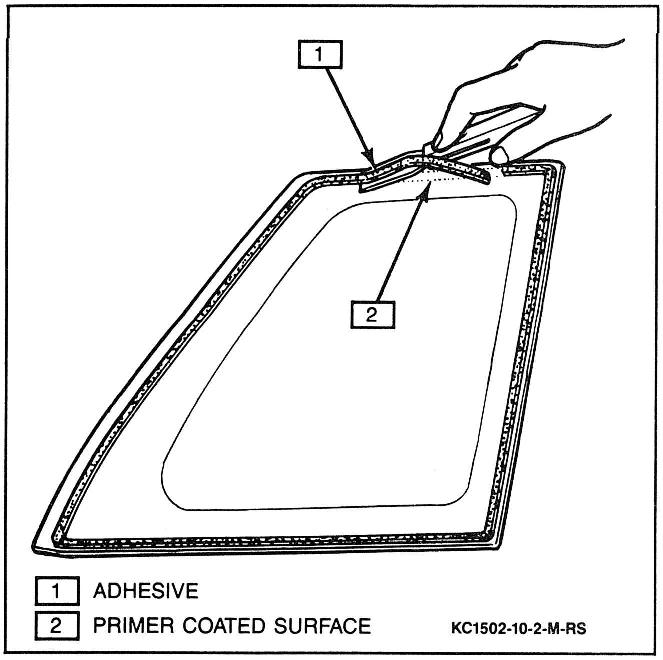

1
2
1 ADHESIVE
2 PRIMER COATED SURFACE
KC1502-10-2-M-RS

Figure 29 Removing Adhesive

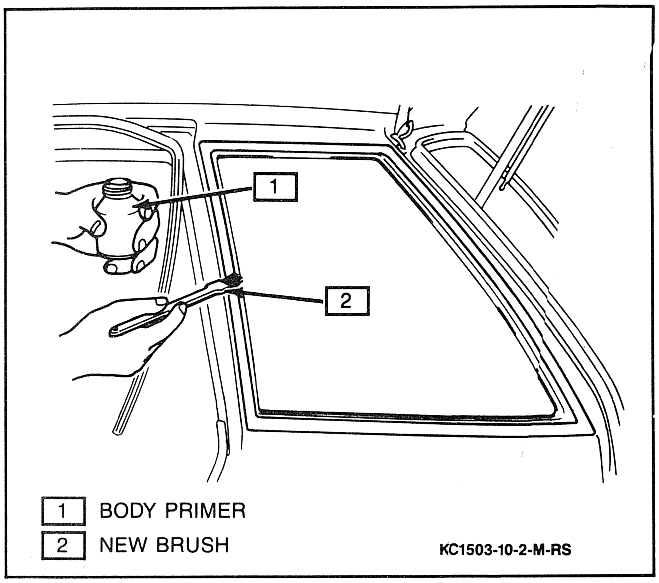

1
2
1 BODY PRIMER
2 NEW BRUSH
KC1503-10-2-M-RS

Figure 30 Primer to Body

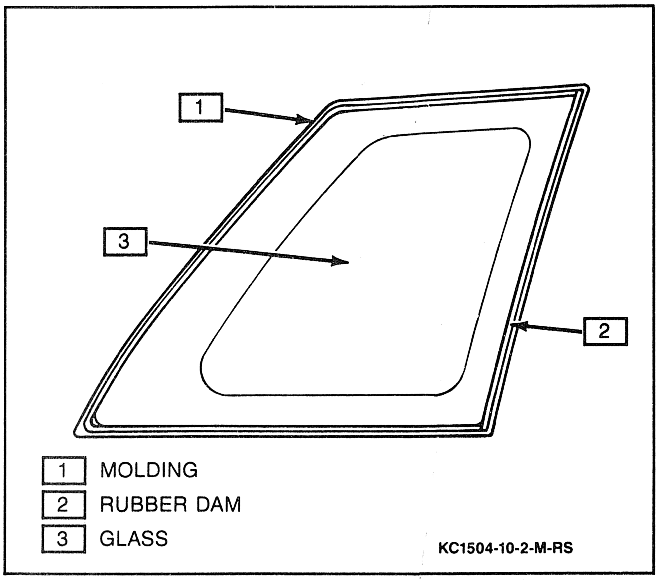

1
3
2
1 MOLDING
2 RUBBER DAM
3 GLASS
KC1504-10-2-M-RS

Figure 31 Window Moldings

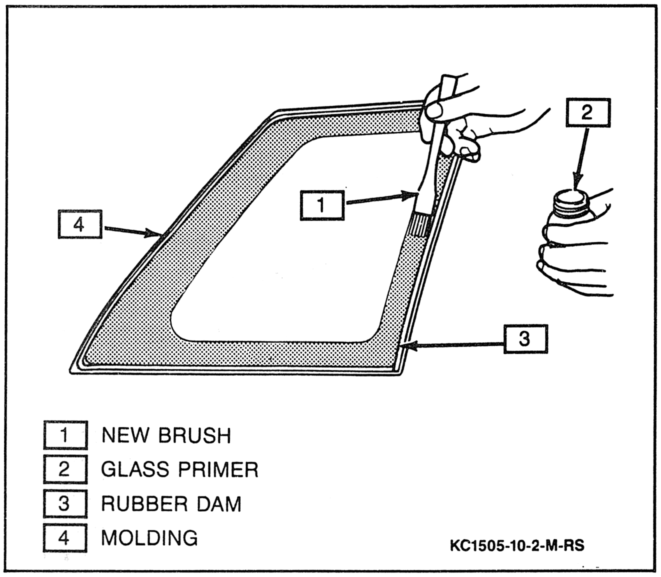

2
1
4
3
1 NEW BRUSH
2 GLASS PRIMER
3 RUBBER DAM
4 MOLDING
KC1505-10-2-M-RS

Figure 32 Primer To Glass

TESTING GRID LINES

Figure 36

To locate inoperative grid lines, start engine and turn on the rear window defogger system. Ground test lamp lead and lightly touch the other prod to each grid line.

If test lamp bulb shows full brilliance at both ends of grid lines, check for loose ground wire contact to body metal.

Test lamp brilliance will decrease as prod is moved further away from feed buss bar.

All grid lines must be tested in at least 2 places to eliminate the possibility of bridging a break. For best results, contact each grid line a few millimeters (inches) on either side of the glass centerline. If an abnormal light reading is apparent on a specific grid line, place test lamp prod on that grid and move prod until light goes out. This will indicate a break in the continuity of the grid line.

GRID LINE REPAIR

Figure 37

Remove or Disconnect

1. Battery feed-rear window defogger system.

Inspect

- Rear window defogger grid lines.
- Mark grid line breaks on outside of glass with a wax pencil or crayon.

Clean

- Grid lines area to be repaired. Buff with steel wool and wipe clean using cloth dampened with alcohol. Buff and clean about 6 mm (1/4 in.) beyond each side of break in grid line.

Remove or Disconnect

1. Grid line repair decal or 2 strips of tape positioned above and below repair area.
    - Repair decal or tape **must** be used to control width of repair area.
    - If decal is used, be sure the die-cut metering slot is the same width as the grid line.
2. Remove the cap (separate from the container of grid repair material).
    - Mix hardener and silver plastic thoroughly.
    - If hardener has crystalized, immerse packet in hot water until the hardener reliquifies.
3. At room temperature, apply grid repair material to repair area using a small wood stick or spatula.
4. Carefully remove the decal or tape.

NOTICE: The grid line repair material must be cured with heat. To avoid heat damage to interior trim, protect the trim near the repair area where heat is to be applied.

5. Apply heat to repair area for 1 to 2 minutes.
    - Hold heat gun nozzle 25 mm (1 in.) from surface.
    - A minimum temperature of 149° C (300° F) is required.

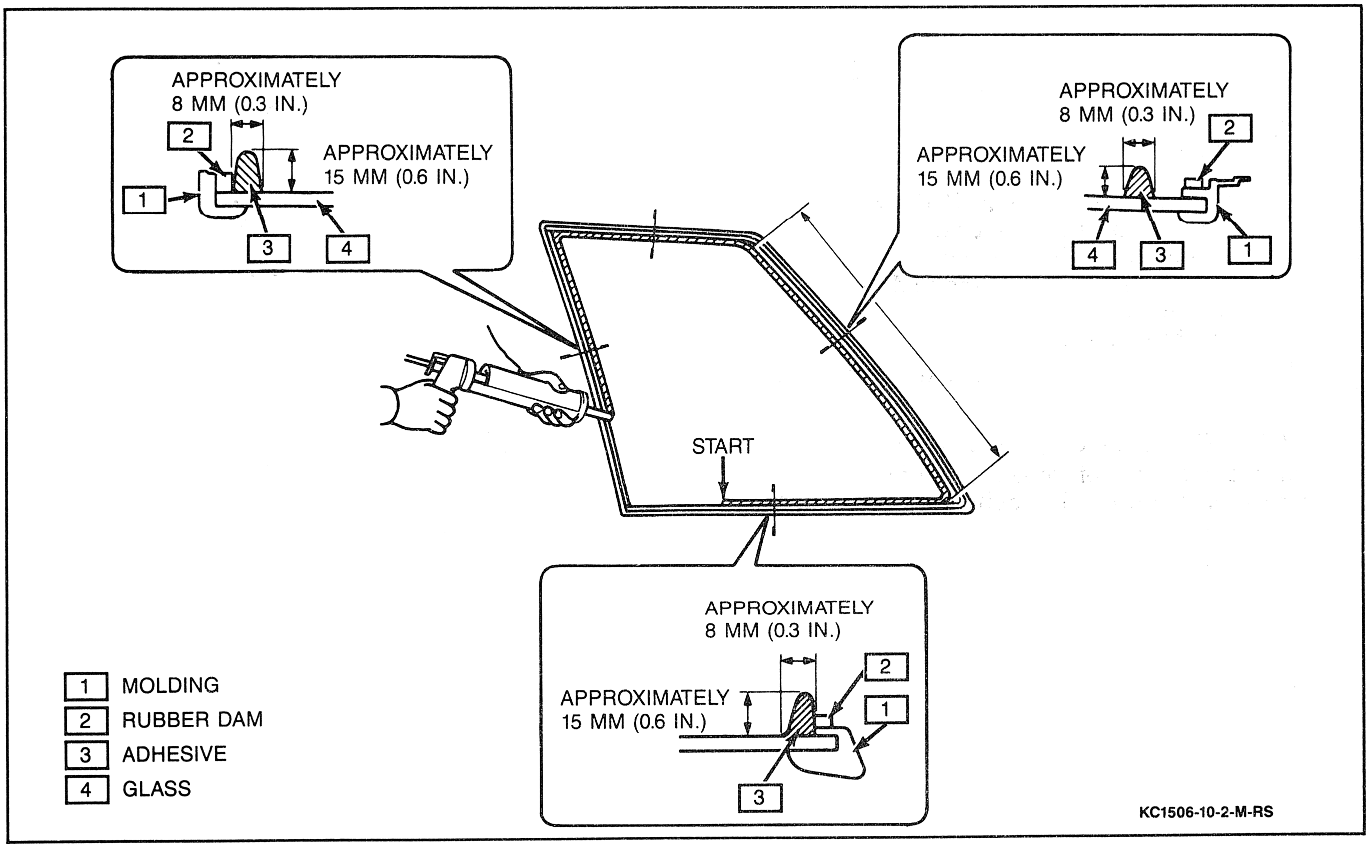

APPROXIMATELY 8 MM (0.3 IN.)
APPROXIMATELY 15 MM (0.6 IN.)
2
1
3
4
APPROXIMATELY 8 MM (0.3 IN.)
APPROXIMATELY 15 MM (0.6 IN.)
2
4
3
1
START
APPROXIMATELY 8 MM (0.3 IN.)
APPROXIMATELY 15 MM (0.6 IN.)
2
1
3
1 MOLDING
2 RUBBER DAM
3 ADHESIVE
4 GLASS
KC1506-10-2-M-RS

Figure 33 Adhesive Application

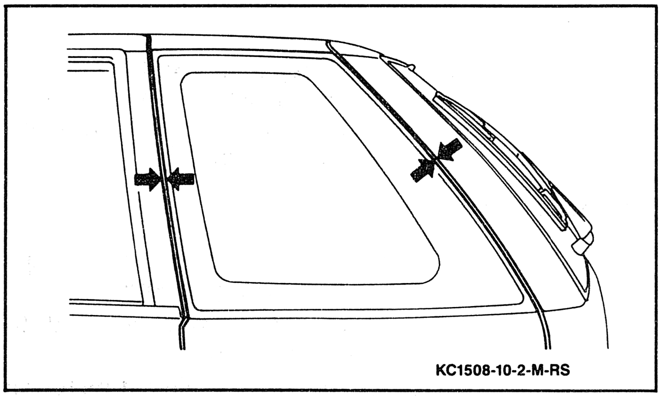

KC1508-10-2-M-RS

Figure 34 Window Clearance

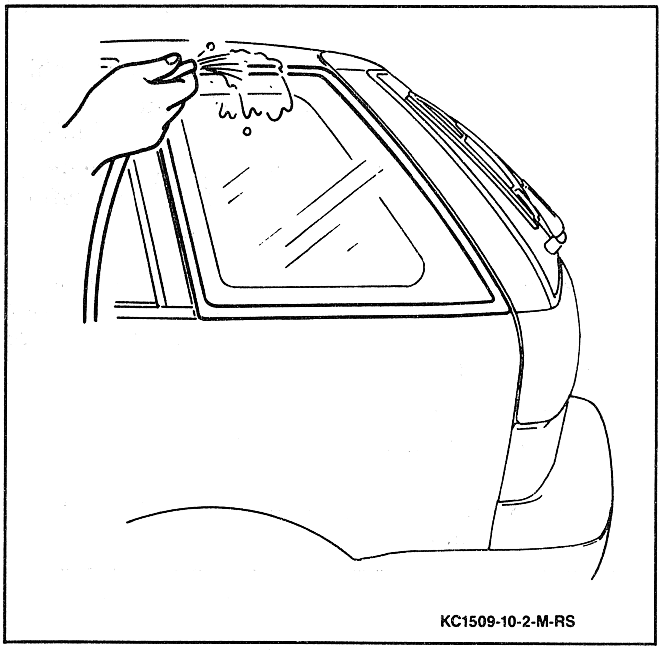

KC1509-10-2-M-RS

Figure 35 Leak Testing

Inspect

- Grid line repair area. If the repair appears discolored, apply a coating of tincture of iodine to repair area using a pipe cleaner or fine brush. Allow iodine to dry for about 30 seconds and carefully wipe off excess with lint free cloth.

6. Test rear defogger operation to verify grid line repair.

NOTICE: At least 24 hours are required for complete curing of repair materials. The repair area should not be physically disturbed until after that time.

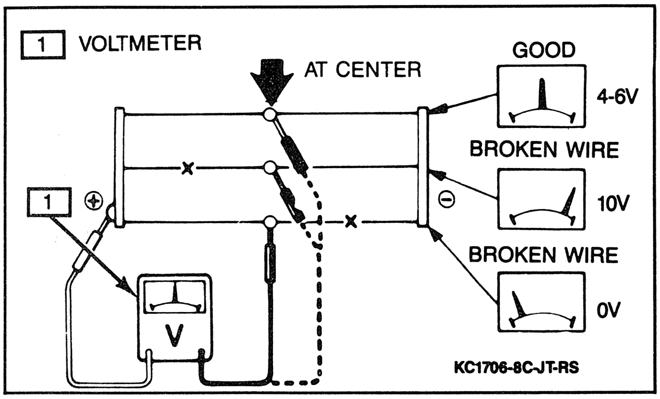

1 VOLTMETER
AT CENTER
GOOD
4-6V
BROKEN WIRE
10V
BROKEN WIRE
0V
1
⊕
⊖
x
x
V
KC1706-8C-JT-RS

Figure 36 Testing Grid

BRAIDED LEAD WIRE REPAIR

The rear defogger buss bar lead wire or terminal can be reattached by resoldering, using a solder containing 3% silver and a rosin flux paste.

1. Before soldering the buss bar, repair area should be buffed with fine steel wool.
2. Apply the paste-type rosin flux in small quantities to the wire lead and buss bar repair area using a brush.
3. The soldering iron tip should be coated with solder beforehand. Use only enough heat to melt the solder and only enough solder to ensure a complete repair.
4. Do not overheat the wire when resoldering to the buss bar.

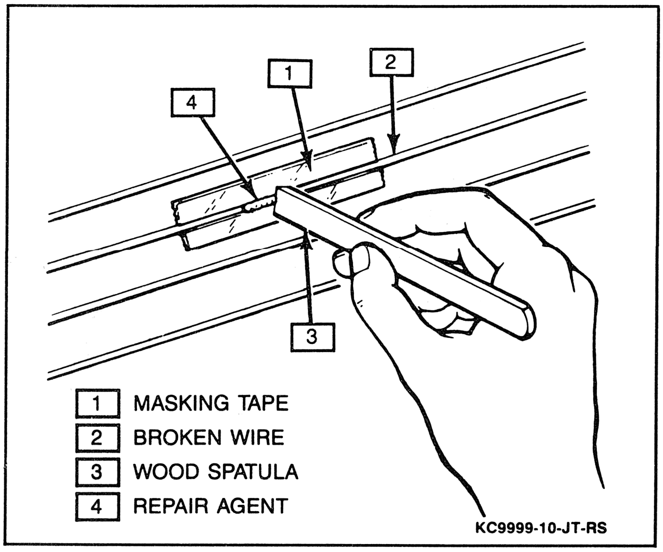

1
2
4
3
1 MASKING TAPE
2 BROKEN WIRE
3 WOOD SPATULA
4 REPAIR AGENT
KC9999-10-JT-RS

Figure 37 Repairing Grid

SECTION 10-3

UNDERBODY

CONTENTS

GENERAL BODY CONSTRUCTION 10-3-1
  Alignment Checking 10-3-1
  Floor Pan Insulator 10-3-1
  Floor Carpets 10-3-3
  Underbody Dimensions 10-3-3

GENERAL BODY CONSTRUCTION

Information in this section pertains to unitized body construction which incorporates integral front and rear frame side rails.

Consideration must be given when checking underbody dimensions. The engine, front suspension lower control arms and rack and pinion steering mount assembly are supported by an engine cradle which is bolted to the body through rubber insulators at four locations. In addition, two rubber insulated struts secure the engine to the upper rail of the engine compartment front panel which is a component of the body structure.

Mounting provisions for the front suspension system are shared by chassis components (suspension lower control arms and engine cradle) and body components (engine compartment side panels). The suspension strut towers must be dimensionally correct in relation to the remainder of the underbody in order to maintain specified suspension strut and caster/camber angles.

Since the individual underbody components also contribute directly to the overall strength of the body, it is essential that proper welding techniques be observed during service repair operations. The underbody components should be properly sealed and rustproofed whenever body repair operations destroy or damage the original sealing and rustproofing. When rustproofing critical underbody components, it is essential to use a quality type of air dry primer such as corrosion-resistant chromate or equivalent material. Combination type primer-surfaces are not recommended.

ALIGNMENT CHECKING

An accurate method of determining the alignment of the underbody utilizes a measuring tram gage. The tram gage set required to perform the recommended measuring checks must include a vertical pointer capable of reaching 914 mm (36″).

Two types of measurements can be made with a tram gage: direct point-to-point measurements and measurements calculated on a horizontal plane (datum line) parallel to the underbody. In the latter case, the height or vertical pointers must be set as specified for each point to be measured.

Point-to-point measurements are generally taken on front structure steering and suspension components and simply require the vertical pointers to be equally set. In some cases point-to-point measurements may be directly taken with a tape measure or appropriate measuring tool (Figures 1 and 3).

Dimensions-to-gage holes are measured to the leading edge or center of the holes and flush to adjacent surface metal. The alphabetically identified points of measurement and metric-to-English dimensional conversion data are given later in this section (Figures 4 and 5).

FLOOR PAN INSULATORS

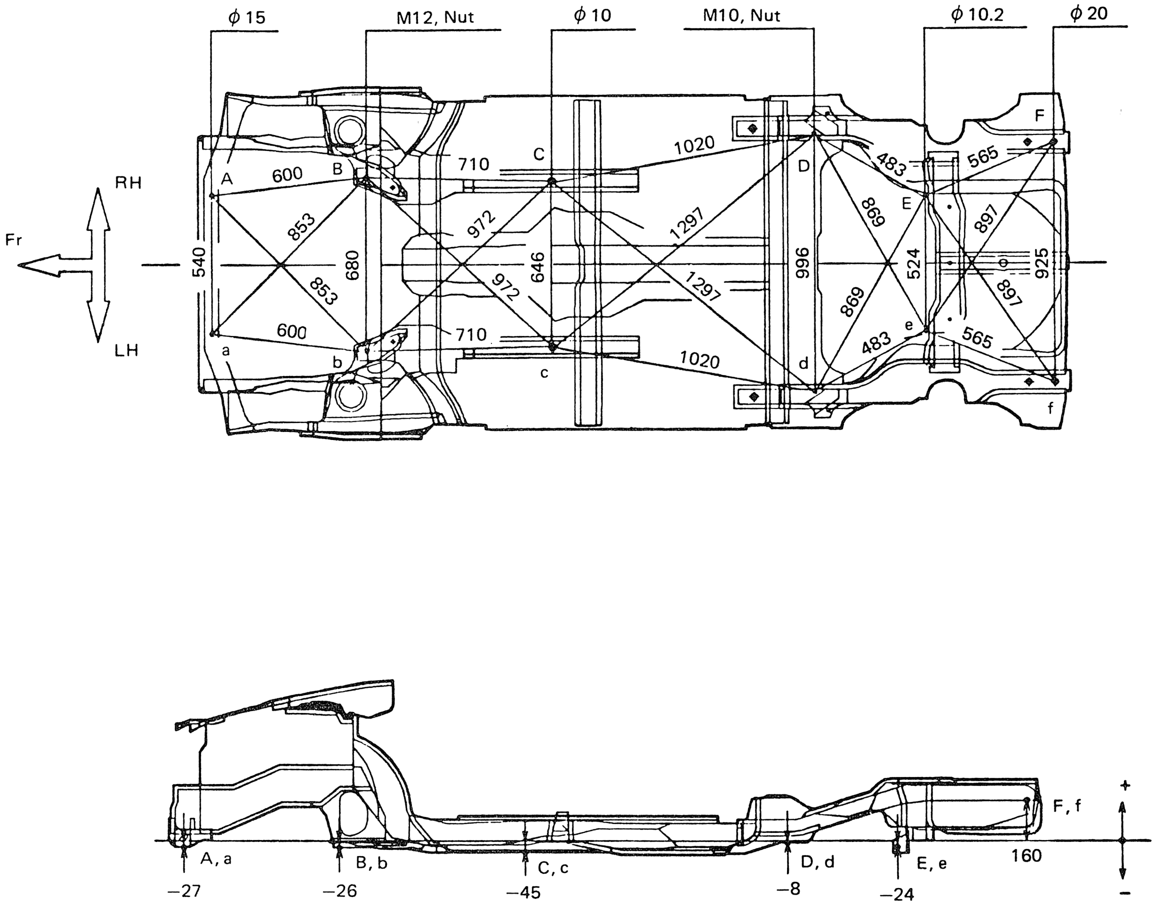
Figure 2

Floor pan insulators have been designed for higher floor pan temperatures that result from the use of the catalytic converter in the exhaust system. Therefore, when servicing a car in the field, it is essential that any insulators that may have been disturbed or removed be reinstalled in the original sequence and location. Also, if it becomes necessary to replace an insulator, the material specified for that particular location on the floor pan must be used.

All of the above materials must meet Motor Vehicle Safety Standard No. 302 for flammability.

When servicing or replacing interior insulators, the following instructions must be observed:

- Insulators must be installed in the original position and sequence. Pieces should be butted together in order to avoid gapping or overlapping.
- If it is necessary to replace an insulator, the specific material must be used.
- Use original part to determine the amount of replacement material required and as a template for cutting and fitting the new piece to the floor pan.
- When installing insulator, do not enlarge cutouts or holes that are used for the attachment of interior components such as seats or seat belts.
- Cross body harness for interior components such as power seats, lap belt warning light and alarm or rear speakers must be routed over the floor pan insulators in the original location and clipped in place.
- Spray-on deadeners and trim adhesives should not be applied to the top of the floor pan at the area directly over the catalytic converter or muffler(s).


ϕ 15
M12, Nut
ϕ 10
M10, Nut
ϕ 10.2
ϕ 20
Fr
RH
LH
A
B
C
D
E
F
a
b
c
d
e
f
540
600
853
680
710
972
646
1020
1297
996
483
869
524
565
897
925
A, a
B, b
C, c
D, d
E, e
F, f
−27
−26
−45
−8
−24
160
+
−

- ALL DIMENSIONS ARE METRIC (UNIT: MM)
- ALL CONTROL POINTS ARE SYMMETRICAL SIDE TO SIDE
- ALL TOLERANCES ARE ± 3 MM

KC1557-10-3-M-RS

Figure 1 Horizontal and Vertical Dimensions

Any insulator service repair or replacement should be the same thickness, size, and location as the original installation in the car.

FLOOR CARPET

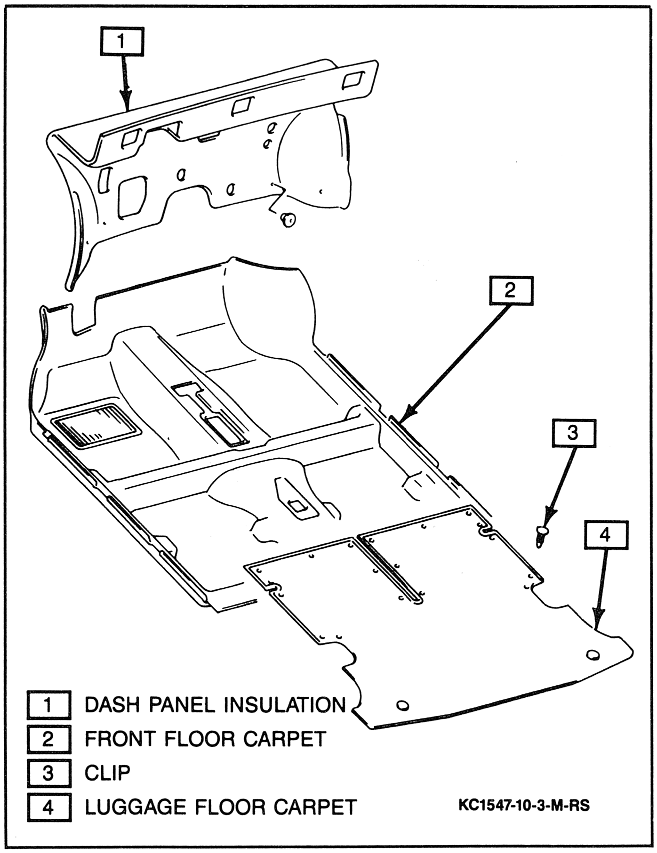


Figure 2 Front and Rear Floor Carpets

Remove or Disconnect

1. Left front seat.
2. Right front seat.
3. Right side sill plate.
4. Left side sill plate.
5. Left side cowl kick pad.
6. Right side cowl kick pad.
7. Left side seat belt bolt lower.
8. Right side seat belt bolt lower.
9. Parking brake cover.
10. Lift rear seat from retaining hooks and remove carpeting.
11. Carpet assembly under dash.

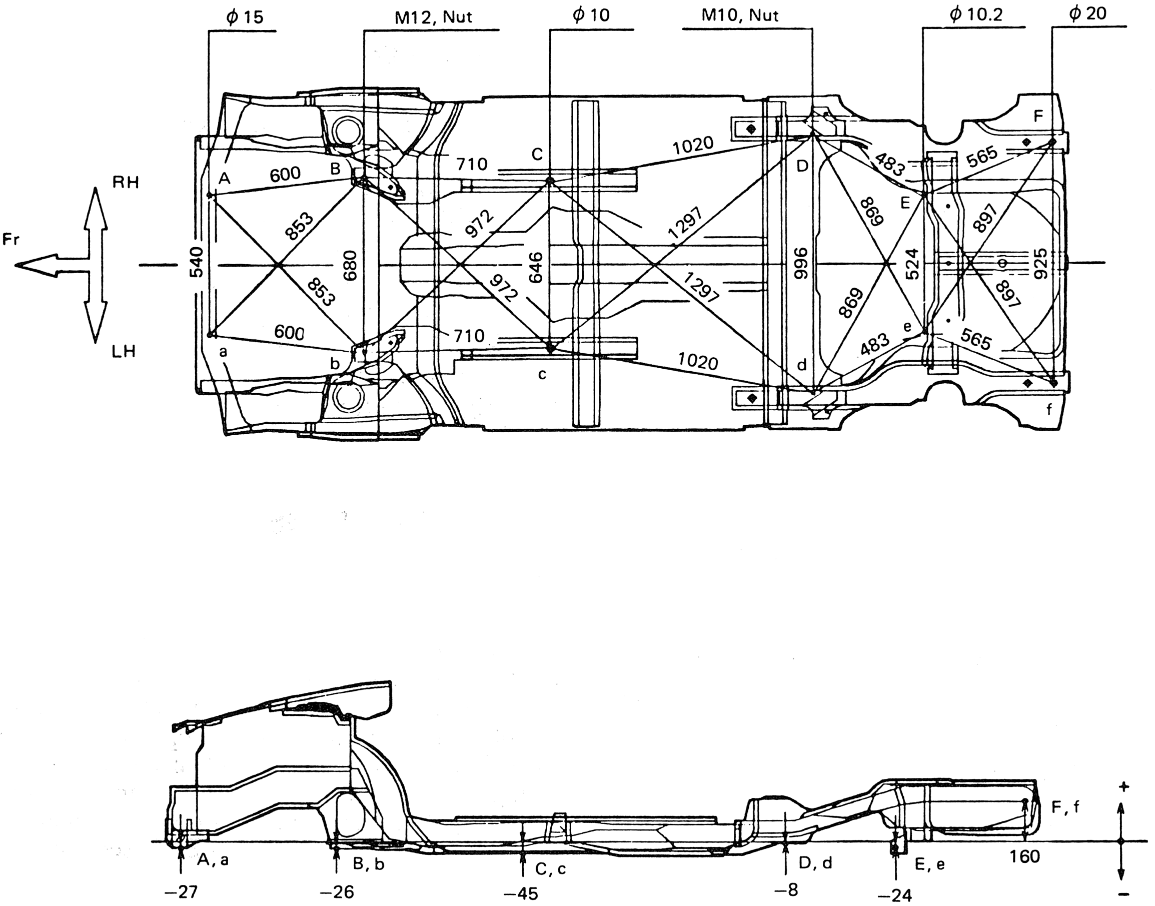
Install or Connect

1. Carpet assembly underdash.
2. Rear seat.
3. Parking brake cover.
4. Right lower seat bolt.
5. Left lower seat bolt.
6. Right side cowl kick pad.
7. Left side cowl kick pad.
8. Right side sill plate.
9. Left side sill plate.
10. Right side front seat.
11. Left side front seat.

UNDERBODY DIMENSIONS

Figures 1, 3, and 4

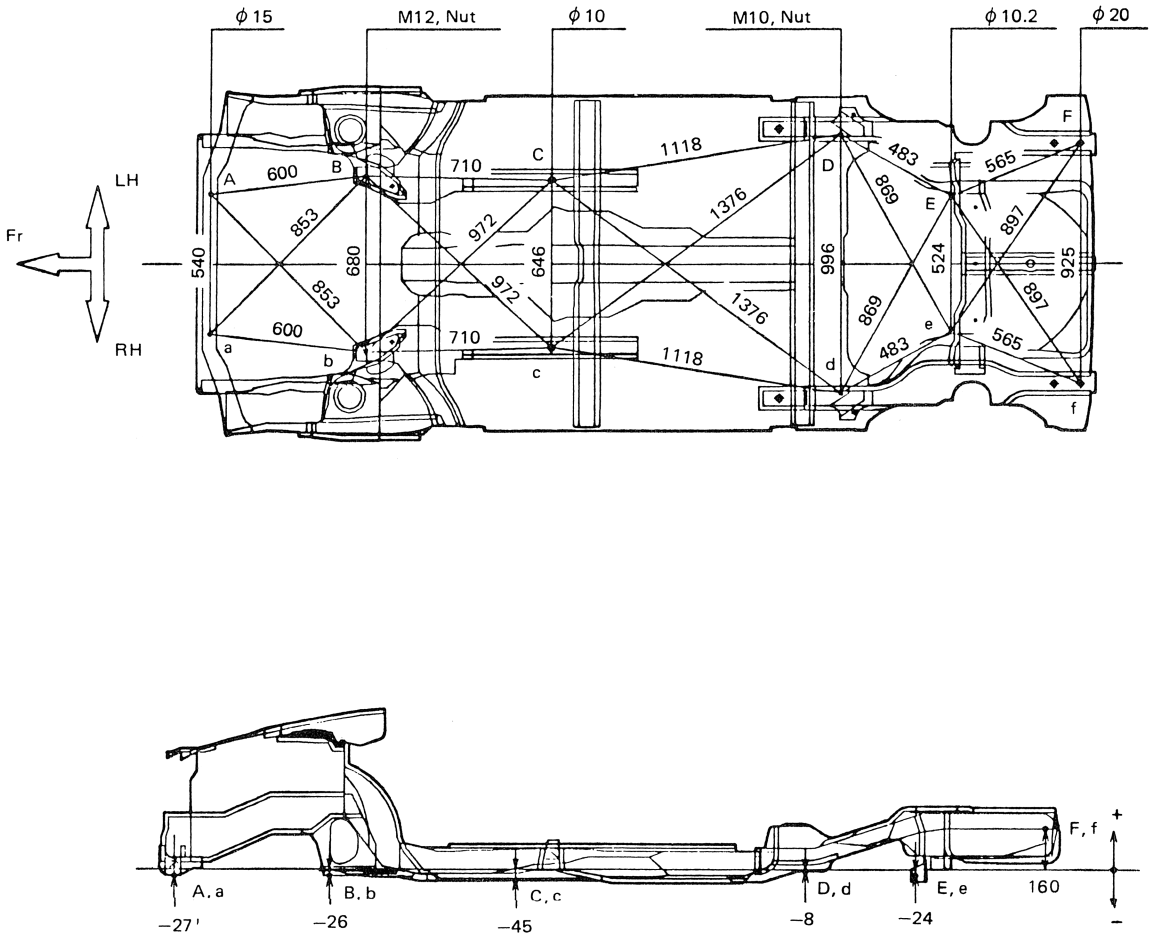
Each underbody component affects strength of the car itself as well as wheel alignment (toe-in, camber, caster). It is essential, therefore, to check underbody carefully and perform welding properly. If necessary, do correction or replacement. When damage is found in sealing or rustproof treatment, it is mandatory to correct it properly. For sealing and rustproof treatment, refer to ANTI-CORROSION TREATMENT section.


ϕ 15
M12, Nut
ϕ 10
M10, Nut
ϕ 10.2
ϕ 20
RH
Fr
LH
A
B
C
D
E
F
a
b
c
d
e
f
600
710
1020
483
565
853
972
1297
869
897
540
680
646
996
524
925
600
710
1020
483
565
A, a
B, b
C, c
D, d
E, e
F, f
–27
–26
–45
–8
–24
160
+
–

- ALL DIMENSIONS ARE METRIC (UNIT: MM)
- ALL CONTROL POINTS ARE SYMMETRICAL SIDE TO SIDE
- ALL TOLERANCES ARE ± 3 MM

KC1557-10-3-M-RS

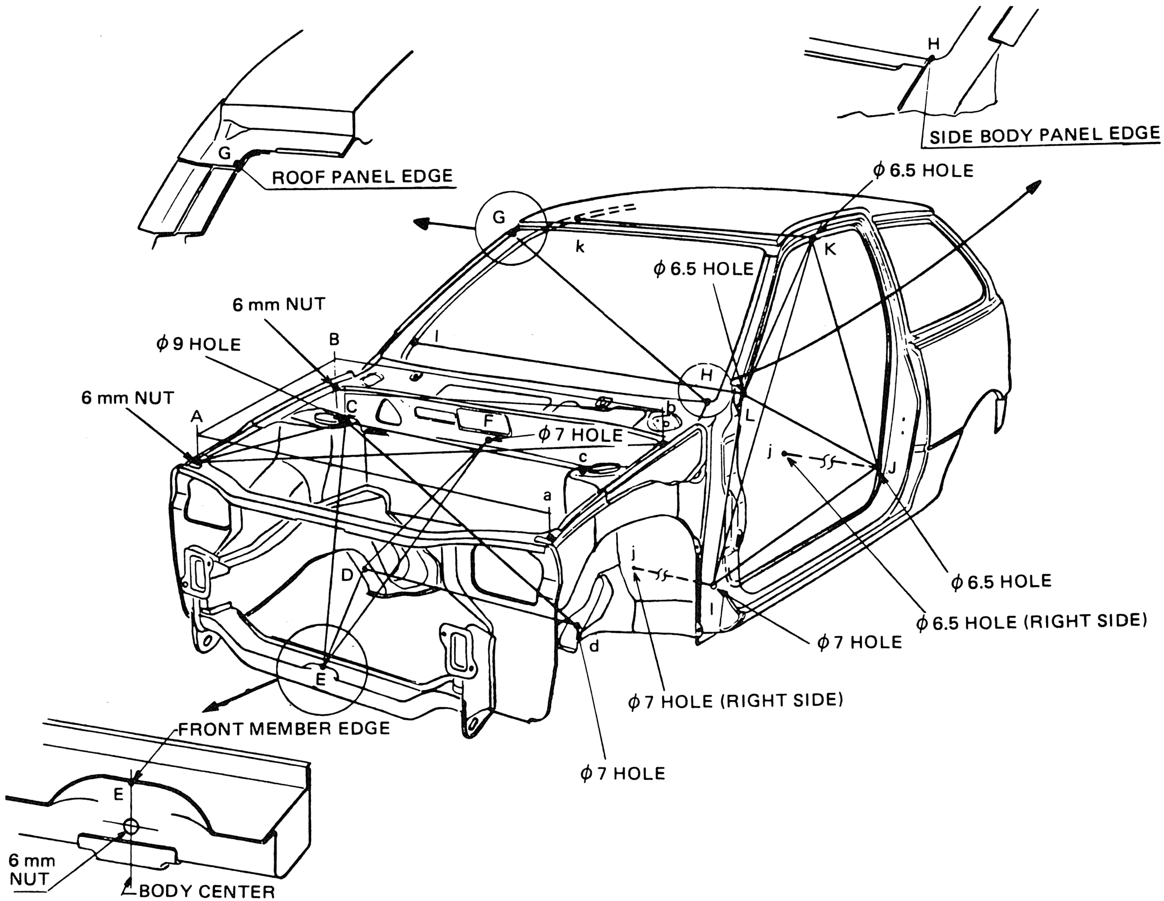
Figure 3 Underbody Dimensions - 3 Door Model


ϕ 15
M12, Nut
ϕ 10
M10, Nut
ϕ 10.2
ϕ 20
Fr
LH
RH
A
B
C
D
E
F
a
b
c
d
e
f
600
600
853
853
972
972
710
710
1118
1118
1376
1376
483
483
869
869
565
565
897
897
540
680
646
996
524
925
A, a
B, b
C, c
D, d
E, e
F, f
160
−27'
−26
−45
−8
−24
+
−

- ●ALL DIMENSIONS ARE METRIC (UNIT: MM)
- ●ALL CONTROL POINTS ARE SYMMETRICAL SIDE TO SIDE
- ●ALL TOLERANCES ARE ± 3 MM

KC1558-10-3-M-RS

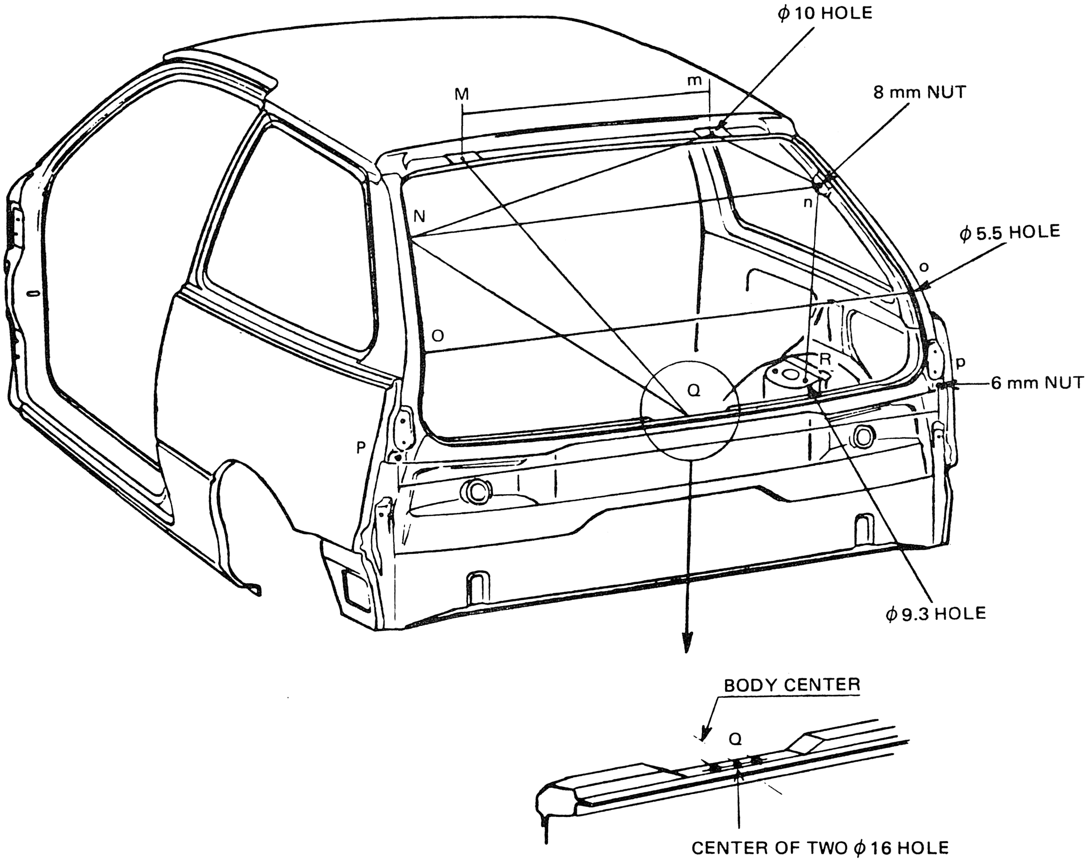
Figure 4 Underbody Dimension - 5 Door Model


H
SIDE BODY PANEL EDGE
G
ROOF PANEL EDGE
ϕ 6.5 HOLE
G
k
K
ϕ 6.5 HOLE
6 mm NUT
ϕ 9 HOLE
B
I
H
6 mm NUT
A
C
F
b
L
ϕ 7 HOLE
c
j
J
a
j
D
ϕ 6.5 HOLE
I
ϕ 6.5 HOLE (RIGHT SIDE)
ϕ 7 HOLE
d
E
ϕ 7 HOLE (RIGHT SIDE)
FRONT MEMBER EDGE
ϕ 7 HOLE
E
6 mm NUT
BODY CENTER

NO.	MEASUREMENT POSITION	LENGTH mm (in.)	NO.	MEASUREMENT POSITION	LENGTH mm (in.)
1	A – a	1 242 (48.90)	13	E – F	846 (33.31)
2	A – b	1 386 (54.57)	14	G – H	1 299 (51.14)
3	A – C	471 (18.54)	15	I – i	1 250 (49,21)
4	A – B	582 (22.91)	16	I – J	1 157 (45.55)
5	B – b	1 273 (50.12)	17	I – K	1 277 (50.28)
6	C – c	908 (35.75)	18	I – L	614 (24.17)
7	C – b	1 101 (43.35)	19	J – j	1 302 (51.26)
8	C – d	950 (37.40)	20	J – L	1 049 (41.30)
9	C – E	896 (35.28)	21	J – K	814 (32.05)
10	D – E	705 (27.76)	22	K – k	988 (38.90)
11	D – d	782 (30.79)	23	K – L	783 (30.83)
12	D – F	589 (23.19)	24	L – I	1 276 (50.24)

KC1559-10-3-M-RS

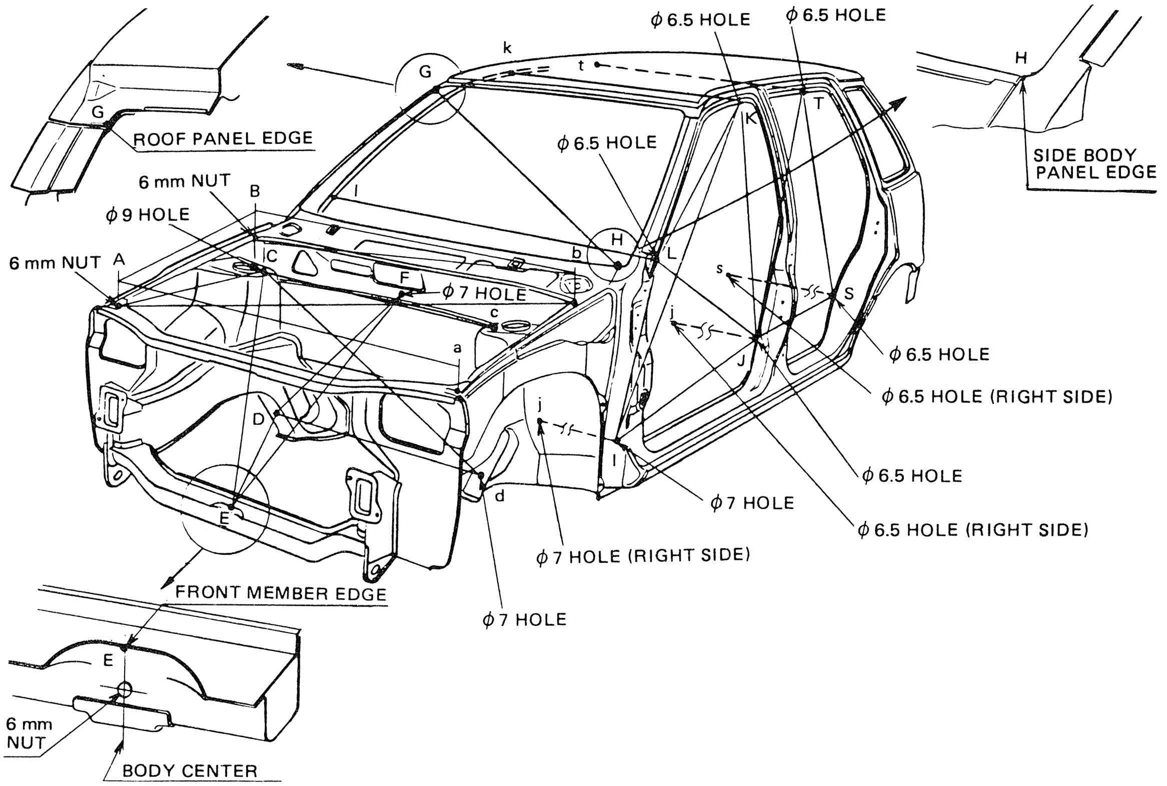
Figure 5 Body Dimensions - 3 Door Model


ϕ 10 HOLE
M
m
8 mm NUT
N
n
ϕ 5.5 HOLE
o
O
R
p
Q
6 mm NUT
P
ϕ 9.3 HOLE
BODY CENTER
Q
CENTER OF TWO ϕ 16 HOLE

NO.	MEASUREMENT POSITION	LENGTH mm (in.)
25	M – m	600 (23.62)
26	M – Q	750 (29.53)
27	N – m	812 (31.97)
28	N – n	983 (38.70)
29	N – Q	708 (27.87)
30	O – o	1 131 (44.53)
31	P – p	1 284 (50.55)
32	R – n	520 (20.47)
33	m – n	264 (10.39)

KC1560-10-3-M-RS

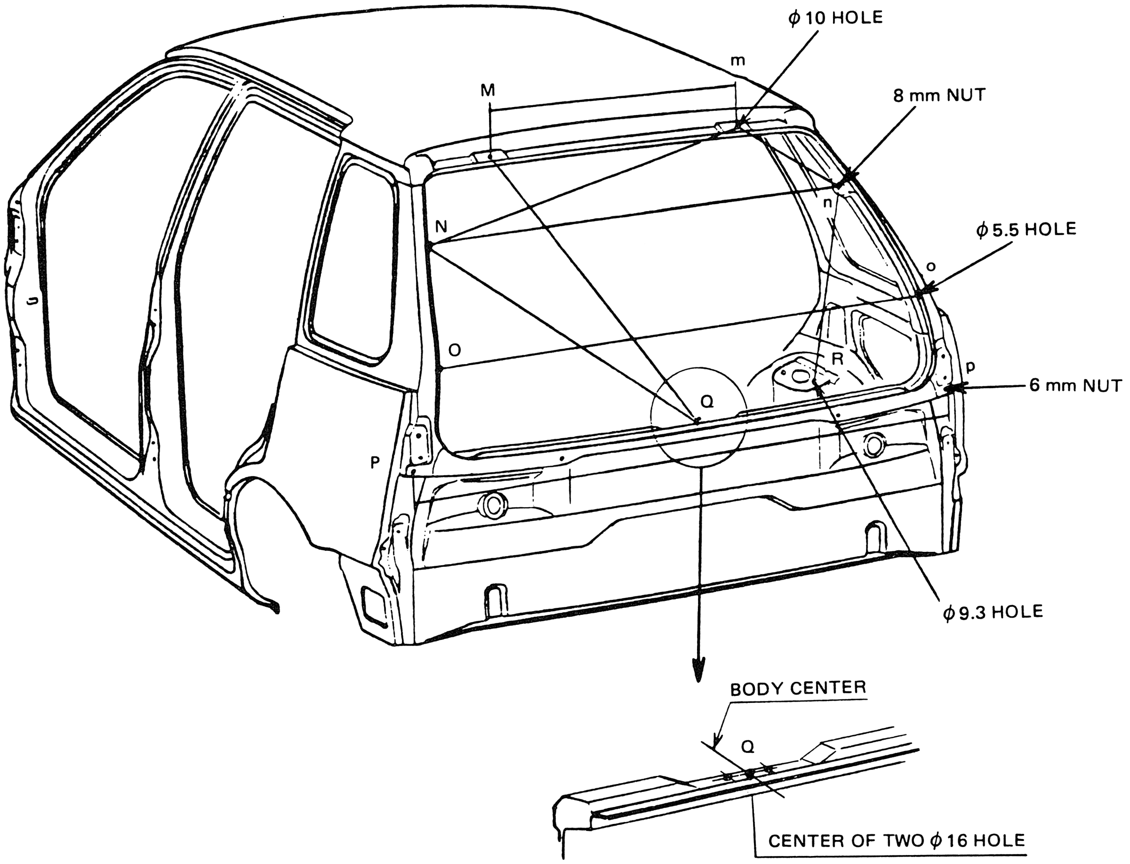
Figure 6 Body Dimensions - 3 Door Model


G
ROOF PANEL EDGE
6 mm NUT
B
ϕ 9 HOLE
6 mm NUT
A
C
k
G
t
ϕ 6.5 HOLE
ϕ 6.5 HOLE
ϕ 6.5 HOLE
K
T
H
SIDE BODY PANEL EDGE
l
H
b
L
F
ϕ 7 HOLE
c
E
s
S
j
J
ϕ 6.5 HOLE
ϕ 6.5 HOLE (RIGHT SIDE)
a
D
j
i
ϕ 6.5 HOLE
ϕ 7 HOLE
d
E
ϕ 6.5 HOLE (RIGHT SIDE)
ϕ 7 HOLE (RIGHT SIDE)
FRONT MEMBER EDGE
ϕ 7 HOLE
E
6 mm NUT
BODY CENTER

NO.	MEASUREMENT POSITION	LENGTH mm (in.)	NO.	MEASUREMENT POSITION	LENGTH mm (in)
1	A – a	1 242 (48.90)	16	I – J	939 (36.97)
2	A – b	1 386 (54.57)	17	I – K	1 382 (54.41)
3	A – C	471 (18.54)	18	I – L	670 (26.38)
4	A – B	548 (21.57)	19	J – j	1 300 (51.18)
5	B – b	1 273 (50.12)	20	J – L	841 (33.11)
6	C – c	908 (35.75)	21	J – K	814 (32.05)
7	C – b	1 101 (43.35)	22	K – k	982 (38.66)
8	C – d	950 (37.40)	23	K – L	839 (33.03)
9	C – E	896 (35.28)	24	L – l	1 253 (49.33)
10	D – E	705 (27.76)	25	J – S	721 (28.39)
11	D – d	782 (30.79)	26	J – T	1 018 (40.08)
12	D – F	589 (23.19)	27	T – S	759 (29.88)
13	E – F	846 (33.31)	28	S – s	1 288 (50.71)
14	G – H	1 316 (51.81)	29	T – t	978 (38.51)
15	I – i	1 250 (49.21)	30		

KC1561-10-3-M-RS

Figure 7 Body Dimension - 5 Door Model


ϕ 10 HOLE
m
M
8 mm NUT
N
n
ϕ 5.5 HOLE
o
O
R
p
6 mm NUT
Q
P
ϕ 9.3 HOLE
BODY CENTER
Q
CENTER OF TWO ϕ 16 HOLE

NO.	MEASUREMENT POSITION	LENGTH mm (in.)
31	M – m	600 (23.62)
32	M – Q	736 (28.98)
33	N – m	819 (32.24)
34	N – n	1 002 (39.45)
35	N – Q	709 (27.91)
36	O – o	1 137 (44.76)
37	P – p	1 284 (50.55)
38	R – n	552 (21.73)
39	m – n	264 (10.39)

KC1562-10-M-RS

Figure 8 Body Dimension - 5 Door Model

SECTION 10-4

FRONT END

CONTENTS

Front End Sealing 10-4-1
Shroud Top Vent Screeen 10-4-1
Door Switch 10-4-1

FRONT END SEALING

All potential water leak locations are sealed in production with high quality durable sealers. Should it be necessary to reseal specific areas, a high quality medium-bonded sealer which will remain flexible after curing and can be painted should be used (Figures 4 and 5).

SHROUD TOP VENT SCREEEN

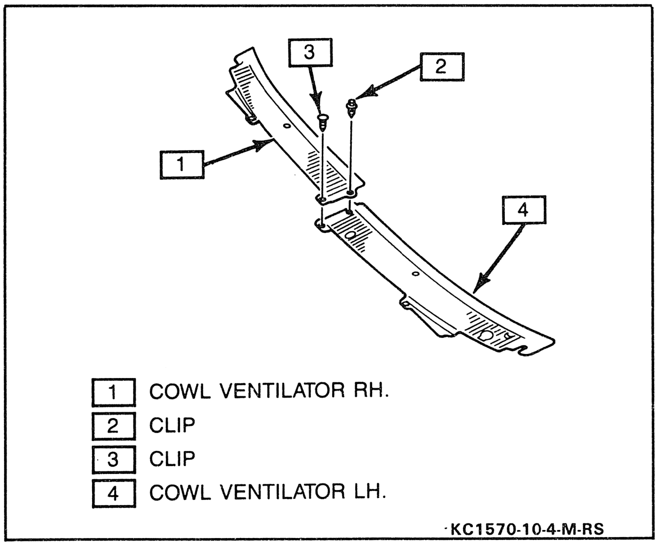

3
2
1
4
1 COWL VENTILATOR RH.
2 CLIP
3 CLIP
4 COWL VENTILATOR LH.
KC1570-10-4-M-RS

Figure 1 Cowl Ventilator

Remove or Disconnect

1. Windshield lower reveal molding.
2. Wiper arm and blade assemblies.
3. Hose for nozzles.
4. Screws.
5. Shroud top vent screen assembly.

Install or Connect

1. Shroud top vent screen assembly.
2. Screws.
3. Hose for nozzles.
4. Wiper arm and blade assemblies.
5. Windshield lower reveal molding.

DOOR JAMB SWITCH

Remove or Disconnect

1. Jamb switch.
2. Electrical connector.

Install or Connect

1. Electrical connector
2. Jamb switch.

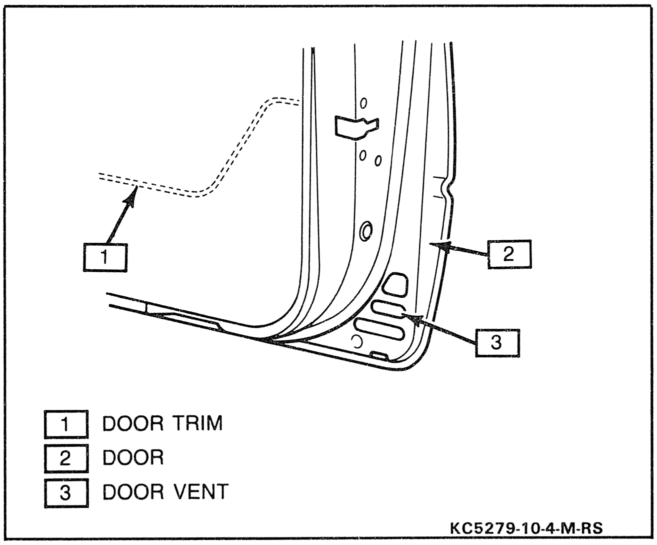

1
2
3
1 DOOR TRIM
2 DOOR
3 DOOR VENT
KC5279-10-4-M-RS

Figure 2 Air Relief Vent

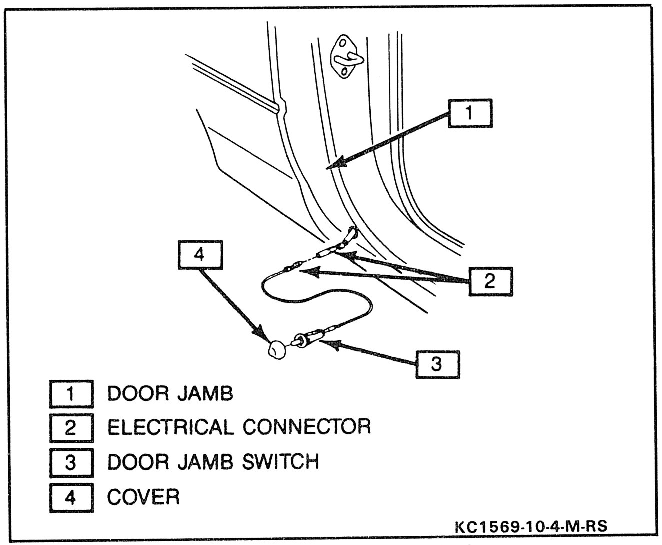

1
4
2
3
1 DOOR JAMB
2 ELECTRICAL CONNECTOR
3 DOOR JAMB SWITCH
4 COVER
KC1569-10-4-M-RS

Figure 3 Door Jamb Switch

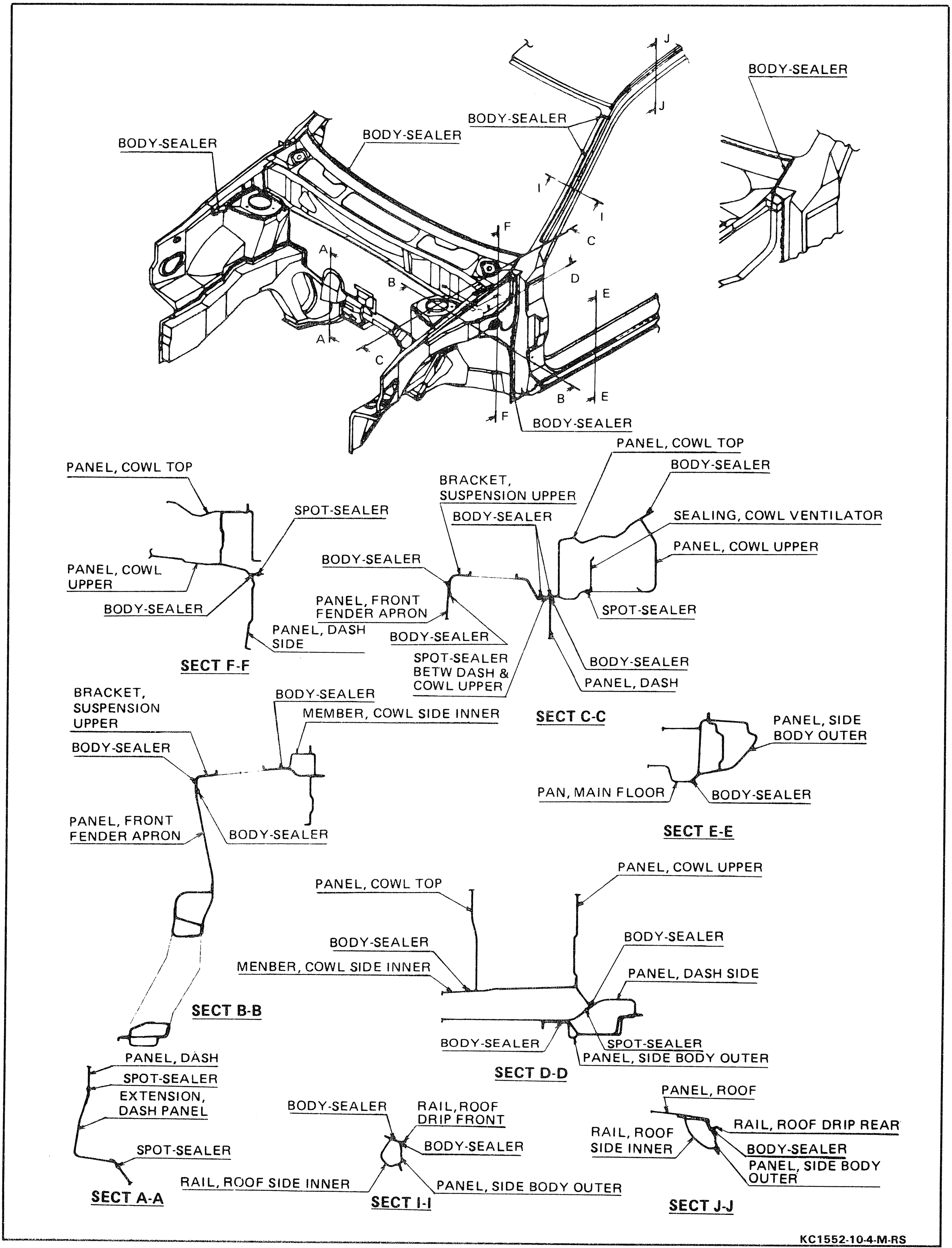
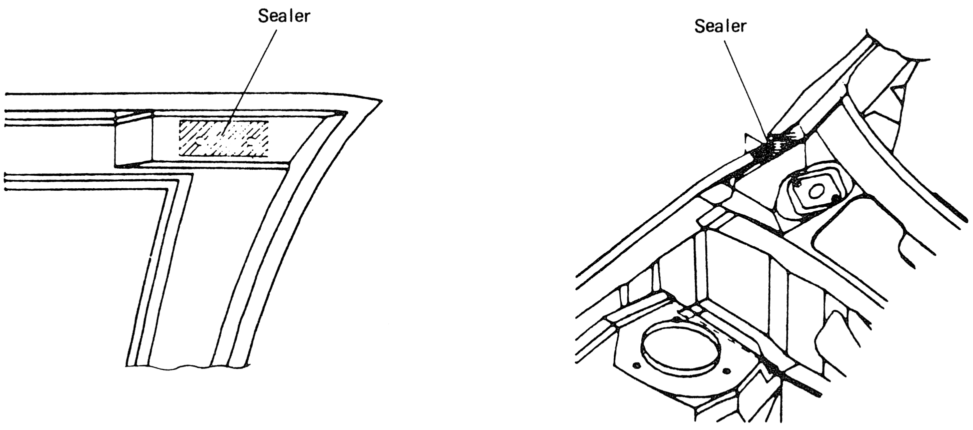
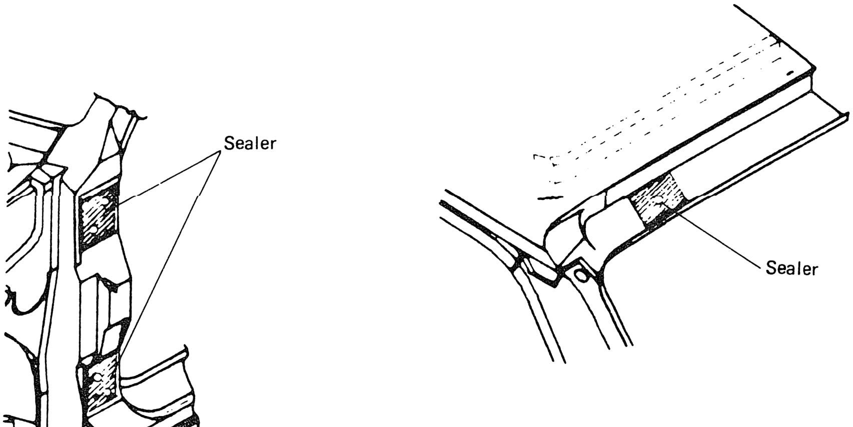

J
J
BODY-SEALER
BODY-SEALER
BODY-SEALER
BODY-SEALER
I
I
F
C
A
D
B
E
A
C
B
E
F
BODY-SEALER
PANEL, COWL TOP
PANEL, COWL TOP
BODY-SEALER
BRACKET, SUSPENSION UPPER
SEALING, COWL VENTILATOR
SPOT-SEALER
BODY-SEALER
PANEL, COWL UPPER
PANEL, COWL UPPER
BODY-SEALER
PANEL, FRONT FENDER APRON
SPOT-SEALER
BODY-SEALER
PANEL, DASH SIDE
BODY-SEALER
SECT F-F
SPOT-SEALER BETW DASH & COWL UPPER
BODY-SEALER
PANEL, DASH
BRACKET, SUSPENSION UPPER
BODY-SEALER
MEMBER, COWL SIDE INNER
SECT C-C
PANEL, SIDE BODY OUTER
BODY-SEALER
PAN, MAIN FLOOR
BODY-SEALER
PANEL, FRONT FENDER APRON
BODY-SEALER
SECT E-E
PANEL, COWL UPPER
PANEL, COWL TOP
BODY-SEALER
BODY-SEALER
MENBER, COWL SIDE INNER
PANEL, DASH SIDE
SECT B-B
BODY-SEALER
SPOT-SEALER
PANEL, DASH
PANEL, SIDE BODY OUTER
SPOT-SEALER
SECT D-D
EXTENSION, DASH PANEL
PANEL, ROOF
BODY-SEALER
RAIL, ROOF DRIP FRONT
RAIL, ROOF DRIP REAR
RAIL, ROOF SIDE INNER
BODY-SEALER
SPOT-SEALER
BODY-SEALER
PANEL, SIDE BODY OUTER
RAIL, ROOF SIDE INNER
PANEL, SIDE BODY OUTER
SECT A-A
SECT I-I
SECT J-J
KC1552-10-4-M-RS

Figure 4 Front End Sealing


Sealer
Sealer

FRONT HOOD

COWL TOP


Sealer
Sealer

FRONT PILLAR

ROOF BACK MEMBER

KC1554-10-4-M-RS

Figure 5 Sealing Points

SECTION 10-5

DOORS

CONTENTS

FRONT DOOR ASSEMBLY 10-5-1
  Front Door Trim 10-5-1
  Water Deflecter 10-5-1
  Front Door Glass 10-5-1
  Sealing Strips 10-5-2
  Door Window Regulator 10-5-2
  Door Handle 10-5-4
  Front Door Weather Strip 10-5-4
  Door Latch and Striker 10-5-5
  Door Lock Cylinder 10-5-5
  Hinge 10-5-6
  Outside Mirror 10-5-6
REAR DOOR ASSEMBLY 10-5-6
  Rear Door Trim 10-5-6
  Rear Door Glass 10-5-7
  Rear Window Regulator 10-5-7
  Rear Door Latch 10-5-7
  Rear Door Handle 10-5-8
  Rear Door Striker 10-5-8
  Rear Door Hinges 10-5-8
  Rear Door Weather Strip 10-5-8

FRONT DOOR ASSEMBLY

FRONT DOOR TRIM

Figures 1 through 4

Remove or Disconnect

1. Inside handle bezel attaching screw.
2. Door arm rest.
3. Window regulator handle, for its removal pull off snap ring by using a cloth (Figure 4).
4. Inner weather strip (5 Door Model).
5. Door trim.

Install or Connect

1. Door trim.
2. Inner weather strip (5 door Model).
3. Window regulator handle.
4. Door arm rest.

NOTICE: Install window regulator handle at 45° angle when glass is fully closed (Figure 4).

WATER DEFLECTOR

Figure 5

Remove or Disconnect

1. Door trim. Refer to "Front Door Trim Removal" earlier in this section.
2. Water deflector.

Important

- Apply adhesive to back of water deflector before installation.

Install or Connect

1. Water deflector.
2. Door trim. Refer to "Front Door Trim Installation" earlier in this section.

FRONT DOOR GLASS

Figures 6 through 9

Remove or Disconnect

1. Inside handle bezel attaching screw.
2. Door arm rest.
3. Window regulator handle, for its removal pull off snap by using a cloth.
4. Inner weather strip (5 Door Model).
5. Door trim.
6. Door seal cover.
7. Fit inside handle bezel back in position temporarily.
8. Door outside weather strip.
9. Glass bottom channel attaching screw.
10. Take out door glass together with bottom channel.
11. Detach glass from bottom channel.

Install or Connect

1. Glass to bottom channel coat with soap and water and tap into bottom channel with plastic hammer; fit to spec. (Figure 7).

   Adjust

   - Equalizer of window regulator measurements A and B so they are equal to each other (Figures 8 and 9).

2. Door weather strip. weather strip.
3. Door seal cover.
4. Door trim.
5. Inner weather strip (5 Door Model).
6. Window regulator handle.
7. Door arm rest.
8. Inside handle bezel attaching screw.

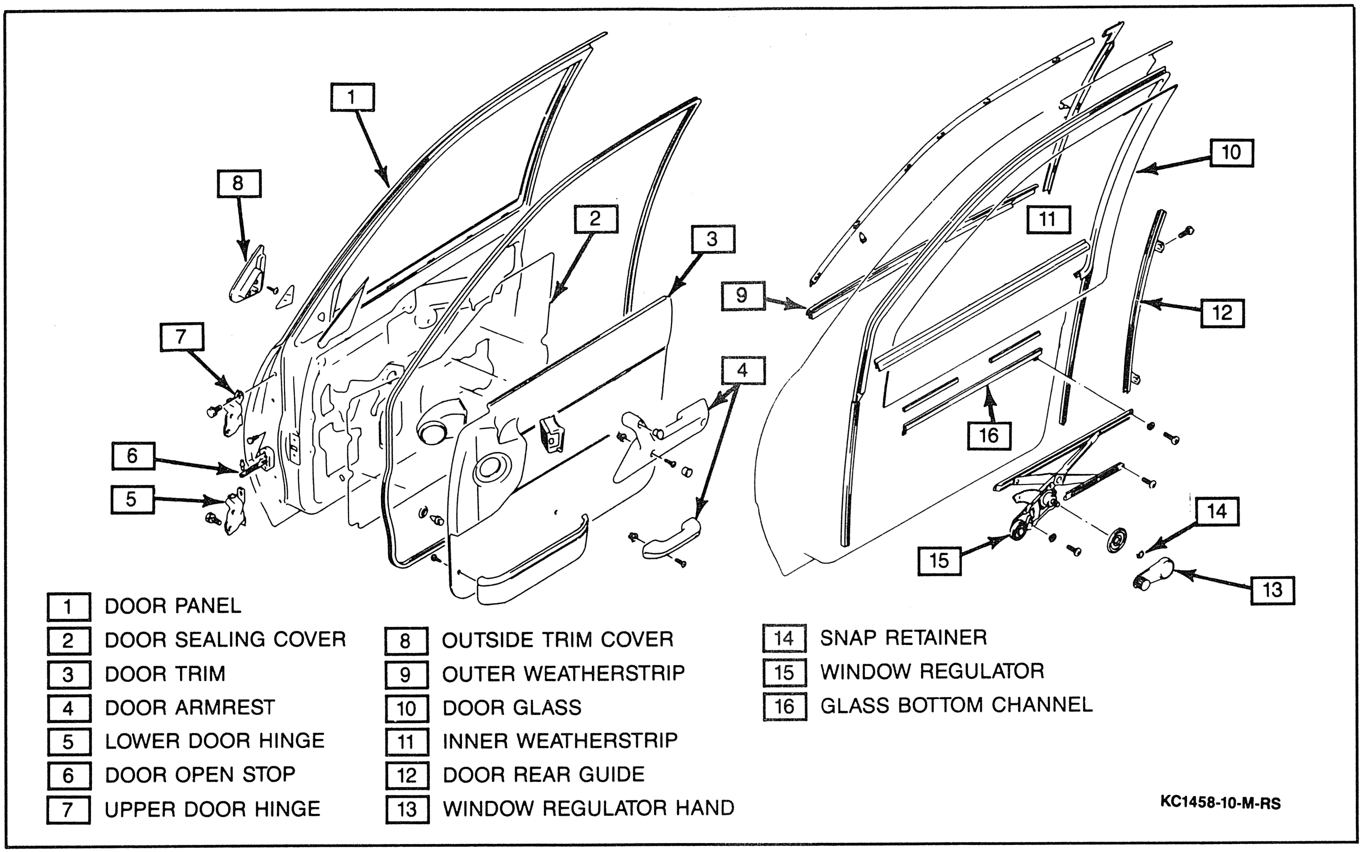

1 DOOR PANEL
2 DOOR SEALING COVER
3 DOOR TRIM
4 DOOR ARMREST
5 LOWER DOOR HINGE
6 DOOR OPEN STOP
7 UPPER DOOR HINGE
8 OUTSIDE TRIM COVER
9 OUTER WEATHERSTRIP
10 DOOR GLASS
11 INNER WEATHERSTRIP
12 DOOR REAR GUIDE
13 WINDOW REGULATOR HAND
14 SNAP RETAINER
15 WINDOW REGULATOR
16 GLASS BOTTOM CHANNEL
KC1458-10-M-RS

Figure 1 Front Door Assembly

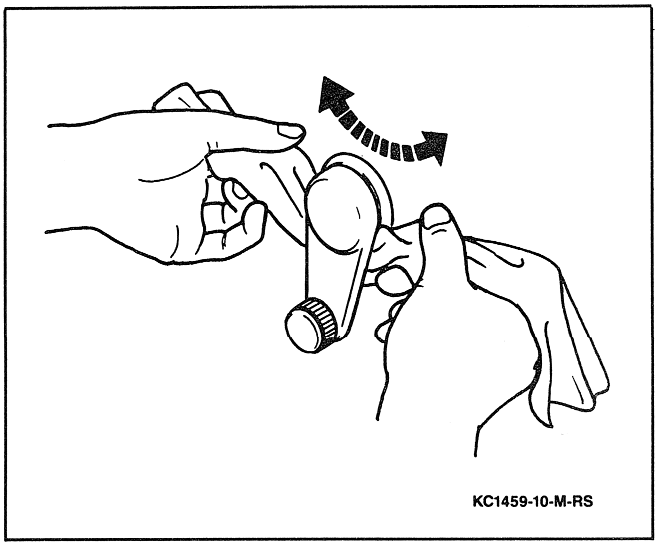

KC1459-10-M-RS

Figure 2 Window Regulator Removal

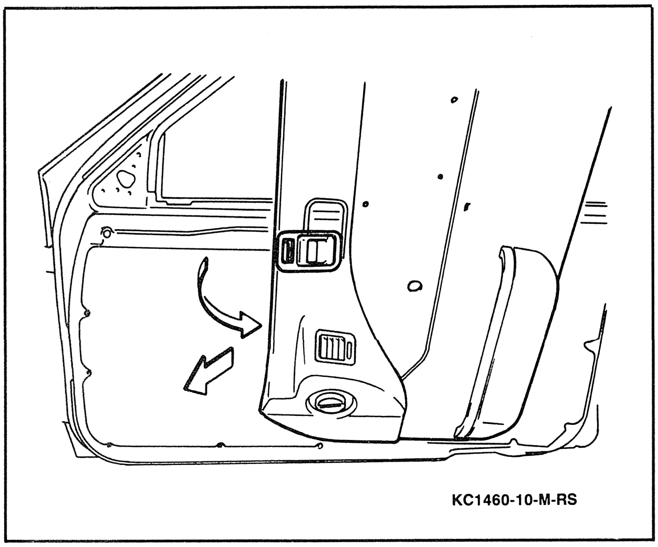

KC1460-10-M-RS

Figure 3 Door Trim

SEALING STRIPS

Inside and Outside

Remove or Disconnect

1. Door trim. Refer to “Front Door Trim Removal” earlier in this section.
2. Inside sealing strip.
3. Outside sealing strip.

Install or Connect

1. Outside sealing strip.
2. Inside sealing strip.
3. Door trim. Refer to “Front Door Trim Installation” earlier in this section.

DOOR WINDOW REGULATOR

Figures 10 and 11

Remove or Disconnect

1. Door Trim and glass. Refer to “Front Door Glass Removal” earlier in this section.
2. Door window regulator attaching screws.

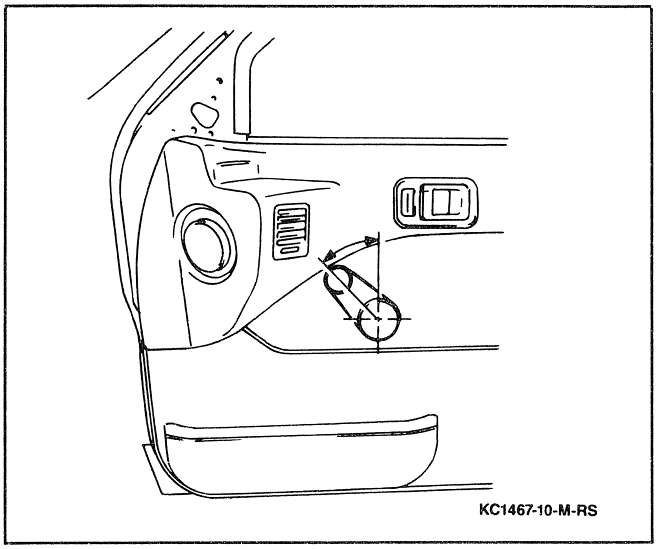

KC1467-10-M-RS

Figure 4 Window Regulator Handle

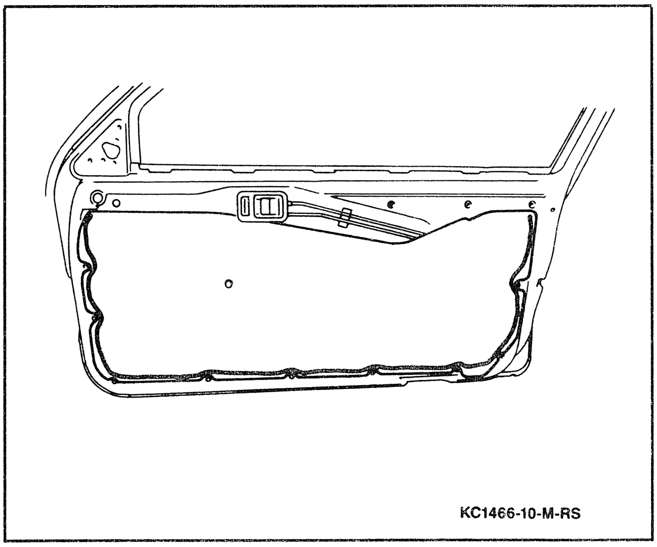

KC1466-10-M-RS

Figure 5 Water Deflector

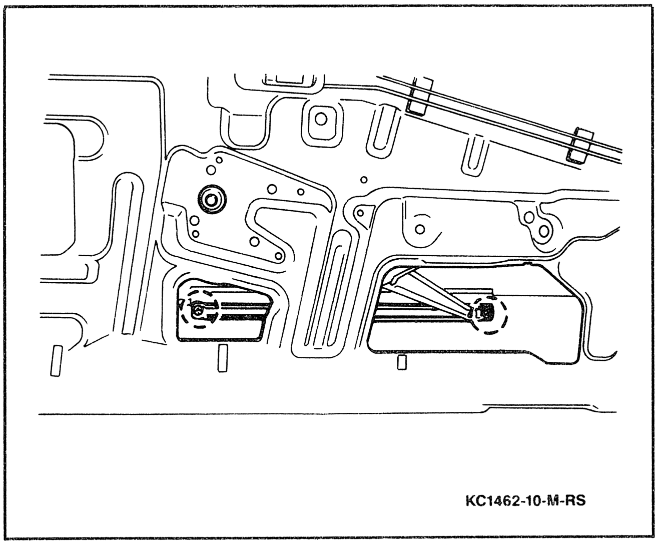

KC1462-10-M-RS

Figure 6 Channel Attaching Screws

3. Regulator from door.

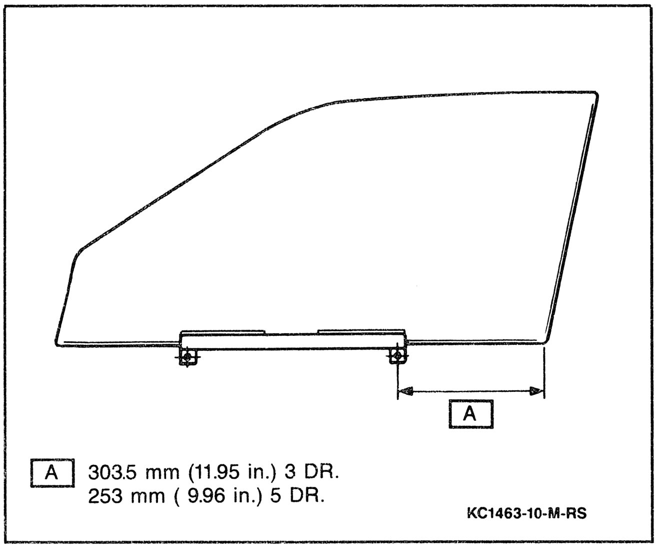

A
A 303.5 mm (11.95 in.) 3 DR.
253 mm (9.96 in.) 5 DR.
KC1463-10-M-RS

Figure 7 Glass Bottom Channel Specification

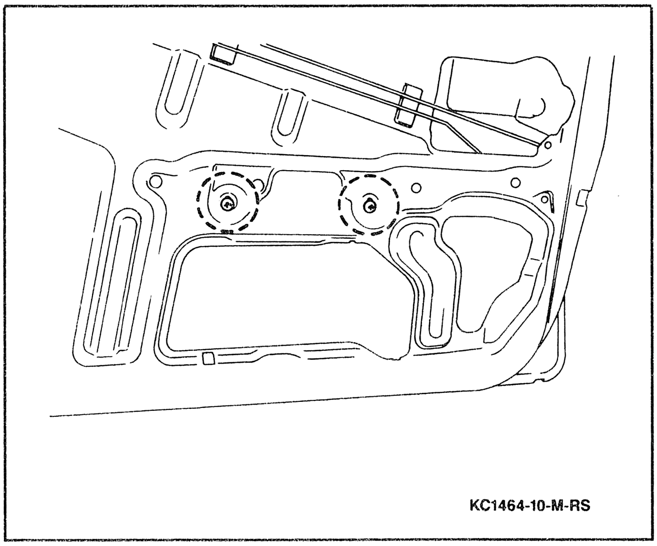

KC1464-10-M-RS

Figure 8 Window Regulator Adjustment Screw

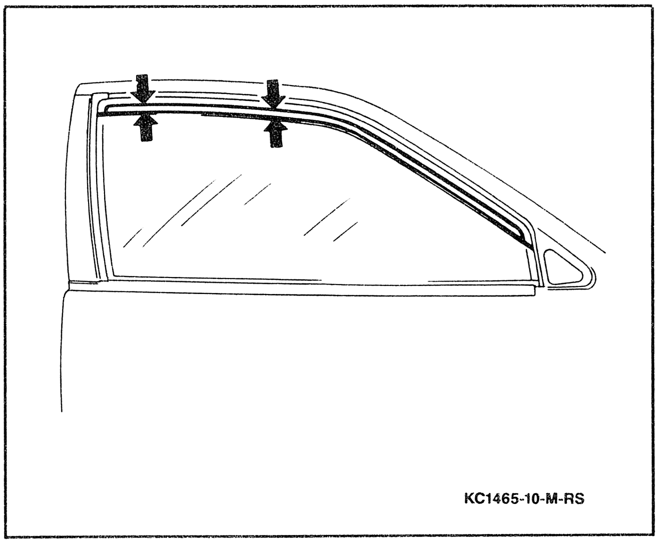

KC1465-10-M-RS

Figure 9 Window Regulator Adjustment

Inspect

- Gear for wear or damage.

- Spring for weakened condition.

Install or Connect

1. Window regulator into door.
2. Window regulator attaching screws.
3. Door trim and glass. Refer to "Front Door Glass Installation" earlier in this section.

NOTICE: Apply multi-purpose grease to sliding parts (Figure 11).

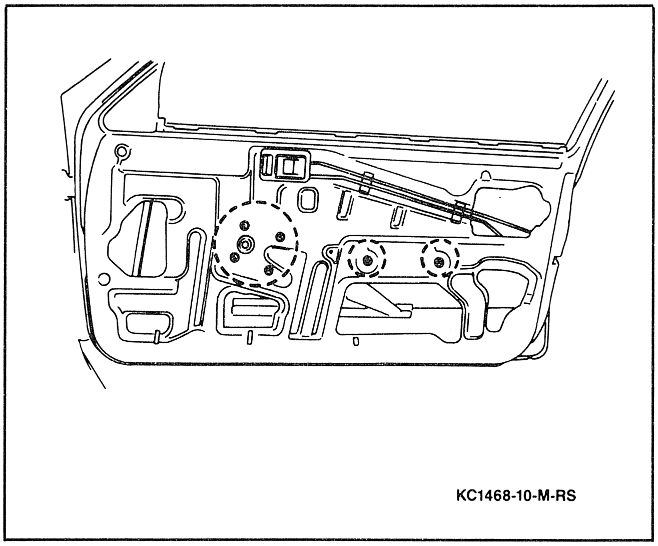


Figure 10 Window Regulator Attaching Screw

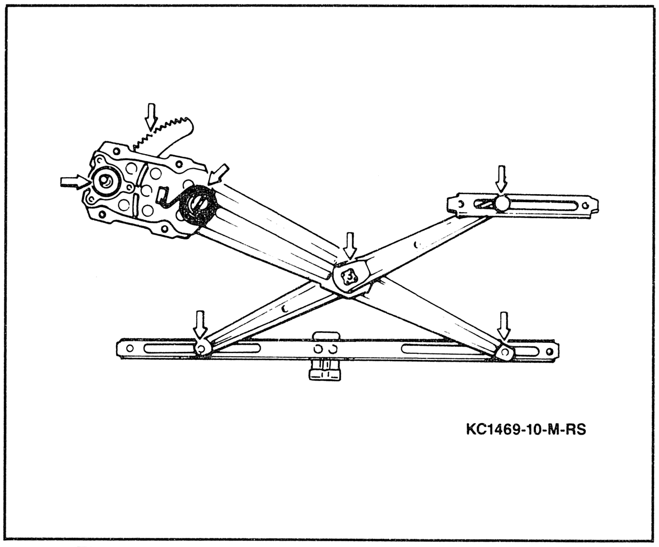


Figure 11 Window Regulator Sliding Parts

OUTSIDE DOOR HANDLE

Figures 12 and 13

Remove or Disconnect

1. Door trim. Refer to "Front Door Trim Removal" earlier in this section.
2. Handle lock rod.
3. Handle attaching bolts.

Install or Connect

1. Handle attaching bolts.
2. Handle lock rod.
3. Door trim. Refer to "Front Door Trim Installation" earlier in this section.

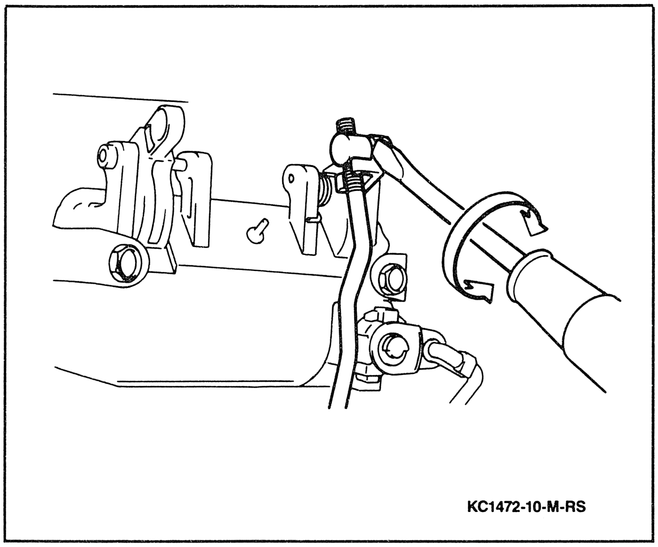


Figure 12 Latch Rod Removal

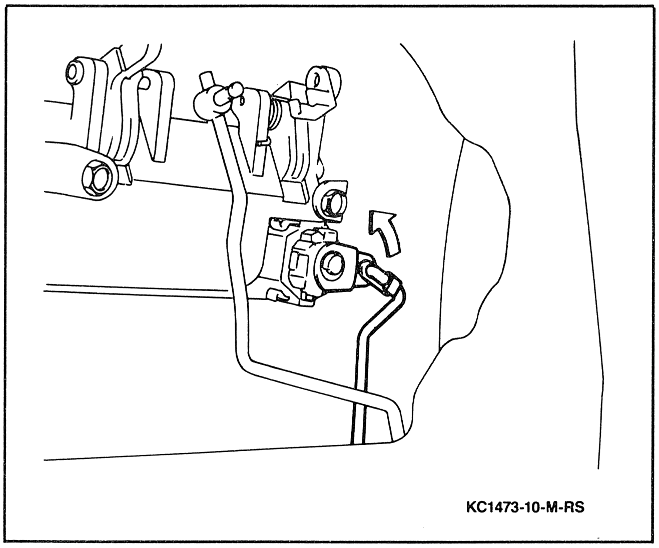


Figure 13 Lock Rod Removal

FRONT DOOR WEATHER STRIP

Remove or Disconnect

1. Door opening stop pin
2. Weather strip.

Install or Connect

1. Weather strip.
2. Door opening stop pin.

DOOR LATCH AND STRIKERS

Figures 14 through 18

Remove or Disconnect

1. Door trim. Refer to “Front Door Trim Removal” earlier in this section.
2. Latch rods.
3. Door latch.

Install or Connect

1. Door latch.
2. Door latch rods.

   Adjust

   - Opening rod distance “A” to 0 to 2 mm. (0 to 0.08 in.).
   - Loosen striker retaining screws.
   - Striker up and down so that the striker shaft aligns with the center of the door latch.
   - Tighten striker retaining screws.
3. Door trim. Refer to “Front Door Trim Installation” earlier in this section.

   Adjust

   - Distance between door and striker using spacers.
   - Distance “D” should be 12.6 to 14.6 mm (0.50 to 0.57 in.).

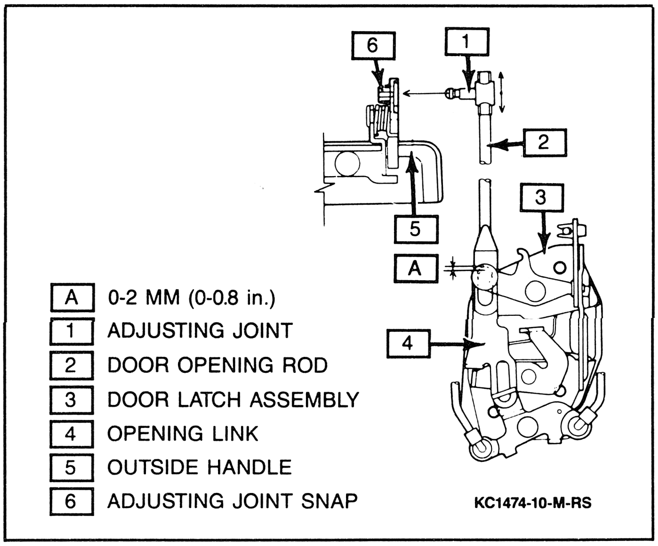

6
1
2
3
5
A
4
A 0-2 MM (0-0.8 in.)
1 ADJUSTING JOINT
2 DOOR OPENING ROD
3 DOOR LATCH ASSEMBLY
4 OPENING LINK
5 OUTSIDE HANDLE
6 ADJUSTING JOINT SNAP
KC1474-10-M-RS

Figure 14 Door Latch and Rods

DOOR LOCK CYLINDERS

Figure 18

Remove or Disconnect

1. Door trim. Refer to “Front Door Trim Removal” earlier in this section.
2. Door lock cylinder rod.
3. Door lock cylinder retaining clip.

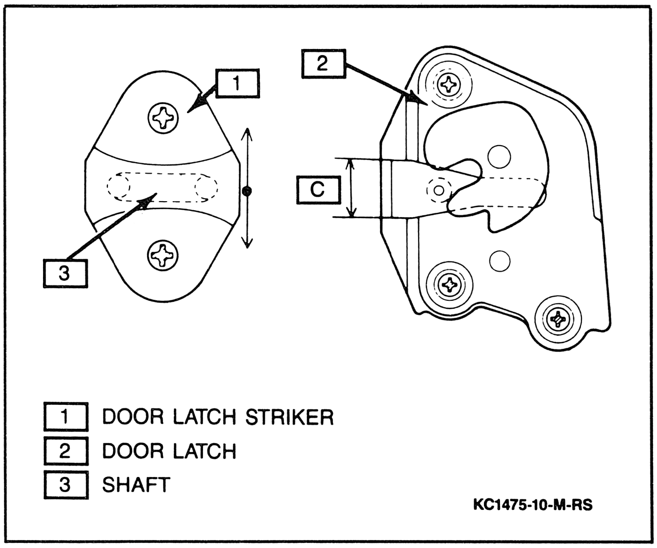

1
2
C
3
1 DOOR LATCH STRIKER
2 DOOR LATCH
3 SHAFT
KC1475-10-M-RS

Figure 15 Striker Alignment

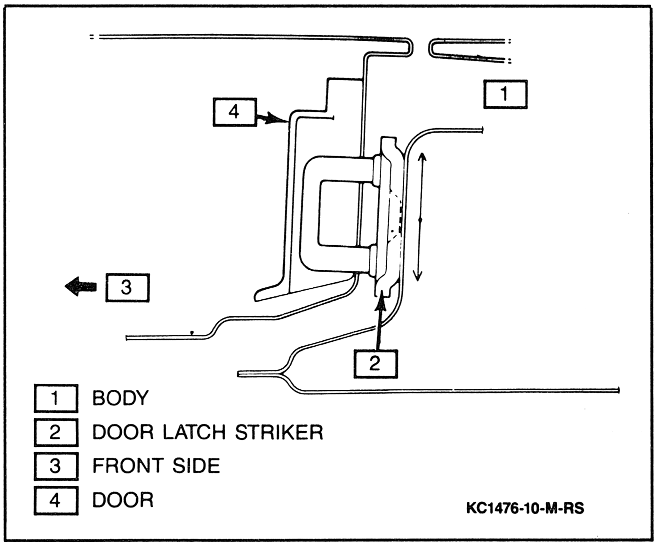

4
1
3
2
1 BODY
2 DOOR LATCH STRIKER
3 FRONT SIDE
4 DOOR
KC1476-10-M-RS

Figure 16 Striker Adjustment

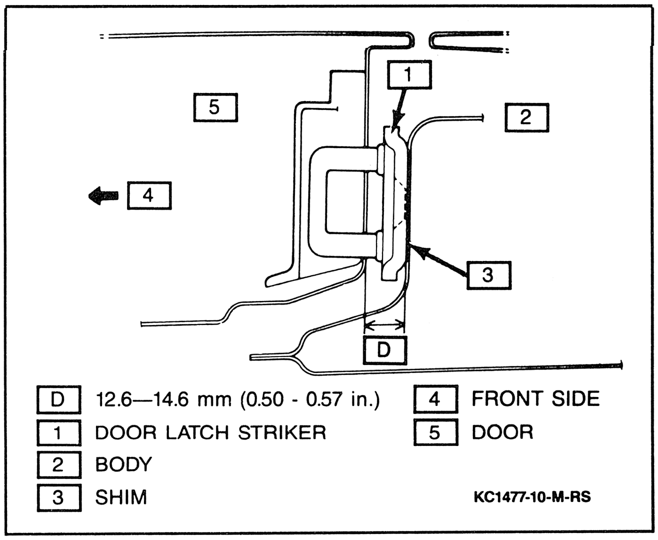

1
5
2
4
3
D
D 12.6—14.6 mm (0.50 - 0.57 in.)
1 DOOR LATCH STRIKER
2 BODY
3 SHIM
4 FRONT SIDE
5 DOOR
KC1477-10-M-RS

Figure 17 Striker Specifications

Install or Connect

1. Door lock cylinder.

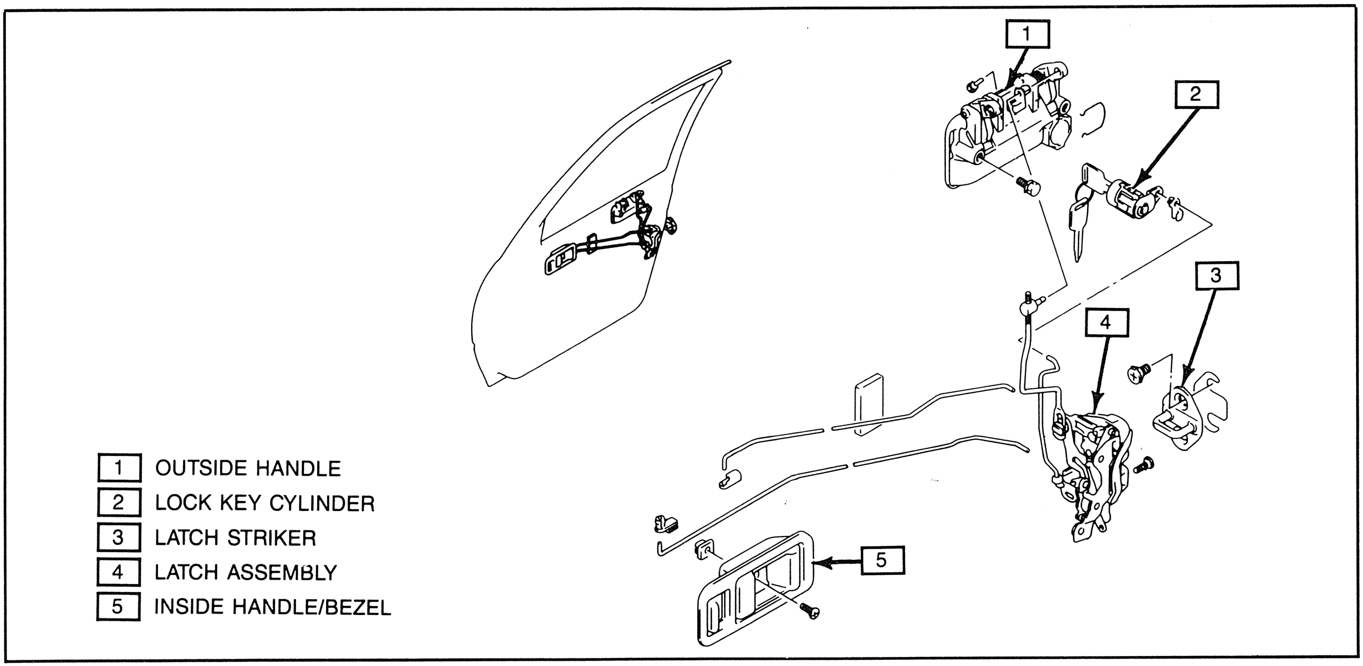

1
2
3
4
5
1 OUTSIDE HANDLE
2 LOCK KEY CYLINDER
3 LATCH STRIKER
4 LATCH ASSEMBLY
5 INSIDE HANDLE/BEZEL

Figure 18 Front Door Lock Assembly

2. Door lock cylinder clip.
3. Door lock cylinder rod.
4. Door trim. Refer to "Front Door Trim Installation" earlier in this section.

HINGE

Figures 19 through 21

Remove or Disconnect

Important

- Use jack to support door and place a piece of wood between jack and door.

2. Upper and lower hinge from door.
3. Door from jack.
4. Upper and lower hinge from pillar.

Install or Connect

1. Upper and lower hinge onto pillar.
2. Door on jack.
3. Upper and lower hinge onto door.

Adjust

- Door striker. Refer to "Door Latch and Striker" earlier in this section.

OUTSIDE MIRROR

Figure 22

Remove or Disconnect

1. Inside Bezel screw.
2. Nut and screw from mirror bezel.
3. Mirror bezel.
4. Gasket.

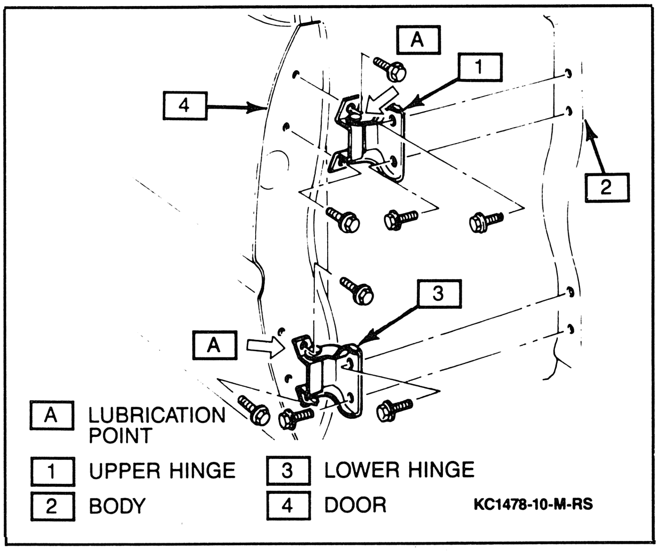

A
1
4
2
3
A
A LUBRICATION POINT
1 UPPER HINGE
3 LOWER HINGE
2 BODY
4 DOOR
KC1478-10-M-RS

Figure 19 Door Hinges

Install or Connect

1. Gasket.
2. Mirror bezel.
3. Nut and screw to miror bezel.
4. Inside bezel screw.

REAR DOOR ASSEMBLY

DOOR TRIM

Figure 23

Remove or Disconnect

1. Inside handle bezel screw.
2. Inside handle opening rod.
3. Door arm rest.
4. Window regulator handle.
5. Door trim.

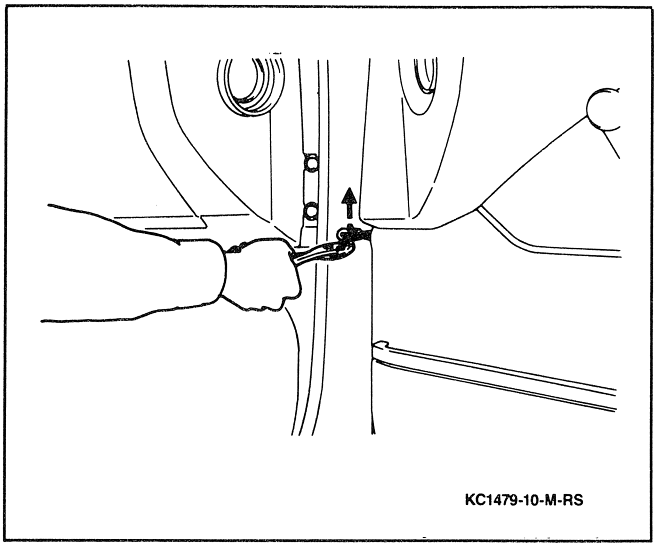


Figure 20 Door Open Stop Pin

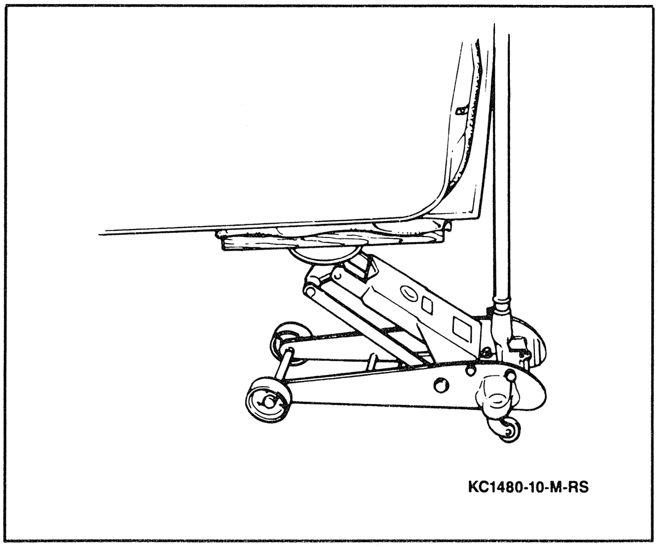


Figure 21 Door Support With Jack

Install or Connect

1. Door trim.
2. Window regulator handle.
3. Door arm rest.
4. Inside handle opening rod.
5. Inside handle bezel screw.

REAR DOOR GLASS

Figures 24 through 28

Remove or Disconnect

1. Door trim. Refer to "Rear Door Trim Removal" earlier in this section.
2. Door inner weather strip.
3. Water deflector.
4. Rear part of glass from center sash.
5. Door outer weather strip and upper molding.

Important

- Lower window fully.

6. Door center sash.
7. Partition glass.
8. Glass fitting screws.
9. Door glass from door.
10. Glass from bottom channel.

Install or Connect

1. Glass to channel. Refer to "Front Door Glass Installation" earlier in this section.
2. Door glass into door.
3. Door glass fitting screws.
4. Partition glass.
5. Door center sash.
6. Door outer weather strip.
7. Upper molding.
8. Water deflector.
9. Inner weather strip.
10. Door trim. Refer to "Rear Door Trim Installation" earlier in this section.

Adjust

- Bottom channel to 53.3 mm (2.11 in.).

REAR WINDOW REGULATOR

Figures 29 through 31

Remove or Disconnect

1. Door trim. Refer to "Rear Door Trim Removal" earlier in this section.
2. Window regulator attaching screws.
3. Regulator from door.

Inspect

- Gear for wear or damage.

Install or Connect

1. Window regulator into door.
2. Attaching screws.

Adjust

- Loosen screws (Figure 31)
- Raise window fully with regulator.
- Tighten four screws (1).
- Lower window.
- Tighten two screws (2).

3. Door trim. Refer to "Rear Door Trim Installation" earlier in this section.

REAR DOOR LATCH

Figure 32

Remove or Disconnect

1. Door trim. Refer to "Rear Door Trim Removal" earlier in this section.
2. Door opening rod.
3. Door lock rod.
4. Door latch.

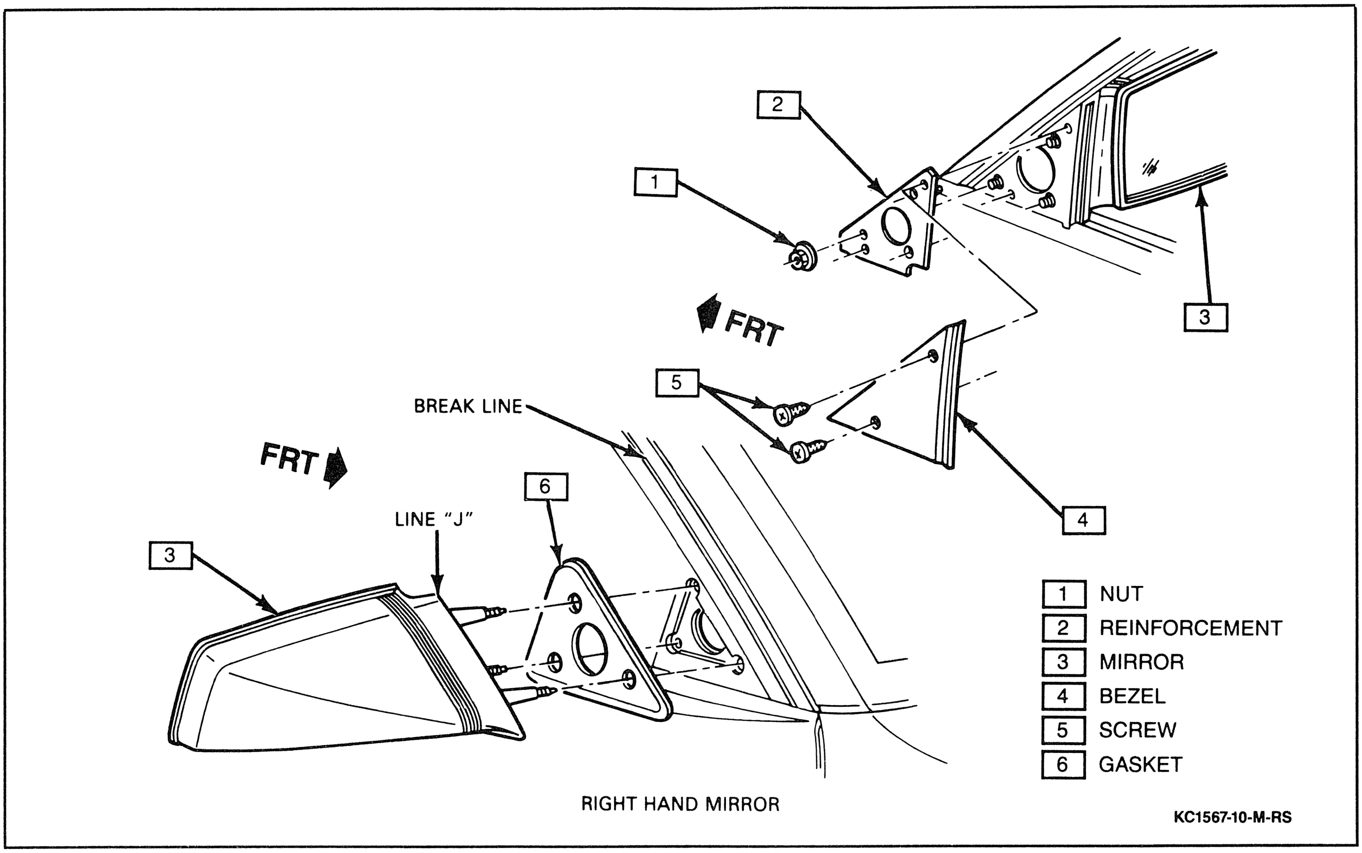

2
1
3
FRT
5
BREAK LINE
FRT
6
LINE "J"
3
4
1 NUT
2 REINFORCEMENT
3 MIRROR
4 BEZEL
5 SCREW
6 GASKET
RIGHT HAND MIRROR
KC1567-10-M-RS

Figure 22 Outside Rear View Mirror Assemblies

Install or Connect

1. Door latch.
2. Door lock rod.
3. Door opening rod.
4. Door trim. Refer to "Door trim Installation" earlier in this section.

REAR DOOR HANDLE

Figure 32

Remove or Disconnect

1. Door Trim. Refer to "Rear Door Trim Removal" earlier in this section.
2. Door opening rod.
3. Door handle bolts.
4. Door handle from door.

Install or Connect

1. Door latch.
2. Door lock rod.
3. Door opening rod.
4. Door trim. Refer to "Rear Door Trim Installation" earlier in this section.

REAR DOOR STRIKER

Remove or Disconnect

1. Door striker screws.

Install or Connect

1. Door striker screws.

Adjust

- Refer to "Front Door Striker Adjustment" earlier in this section.

REAR DOOR HINGES

For removal procedures refer to "Front Door Hinge" earlier in this section.

REAR DOOR WEATHER STRIPS

Remove or Disconnect

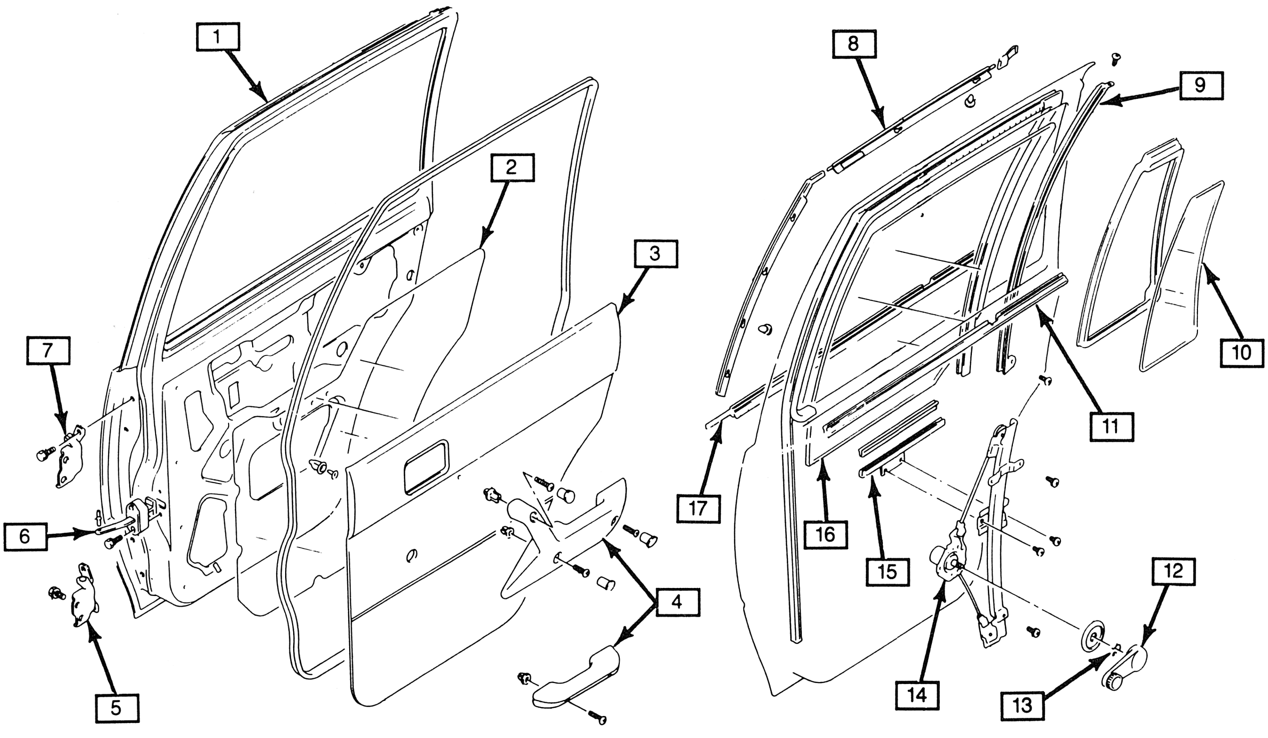
1. Weather strips.

Clean

- Body surfaces.

Install or Connect

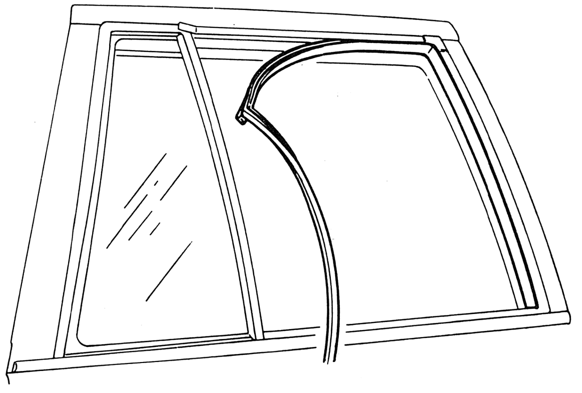
1. Weather strips.



1	DOOR PANEL	8	UPPER MOLDING	15	GLASS BOTTOM CHANNEL
2	DOOR SEAL COVER	9	DOOR GUIDE CENTER	16	~~DOOR~~ GLASS
3	DOOR TRIM	10	PARTITION GLASS	17	OUTSIDE WEATHERSTRIP
4	DOOR ARM	11	INTER WEATHERSTRIP		
5	DOOR LOWER HINGE	12	WINDOW REGULATOR HANDLE		
6	DOOR OPEN STOP	13	SNAP RETAINER		
7	DOOR UPPER HINGE	14	WINDOW REGULATOR		

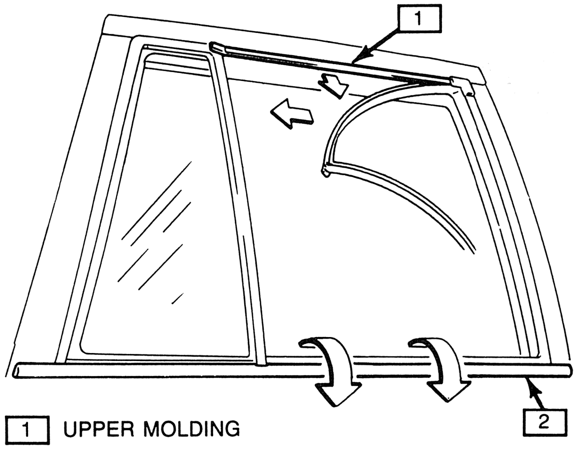
KC1481-10-M-RS

Figure 23 Rear Door Assemblies



KC1483-10-M-RS

Figure 24 Inner Weather Strip Molding Removal



1 UPPER MOLDING
2 OUTER WEATHERSTRIP

KC1484-10-M-RS

Figure 25 Rear Door Glass Weather Strip Removal

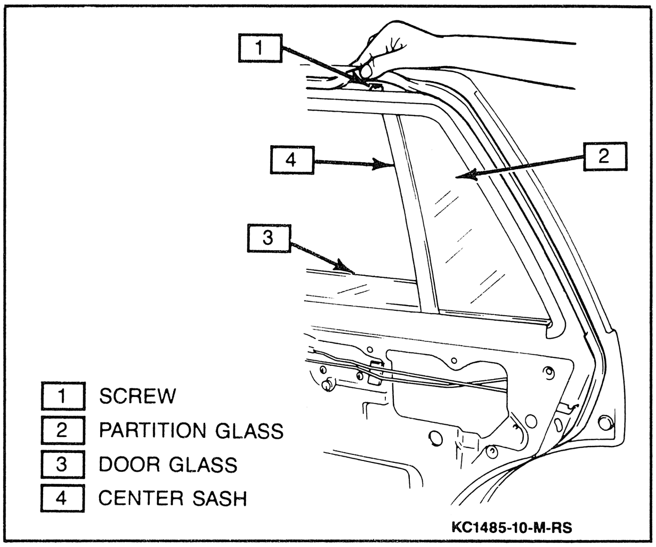

1
4
2
3
1 SCREW
2 PARTITION GLASS
3 DOOR GLASS
4 CENTER SASH
KC1485-10-M-RS

Figure 26 Center Sash Removal

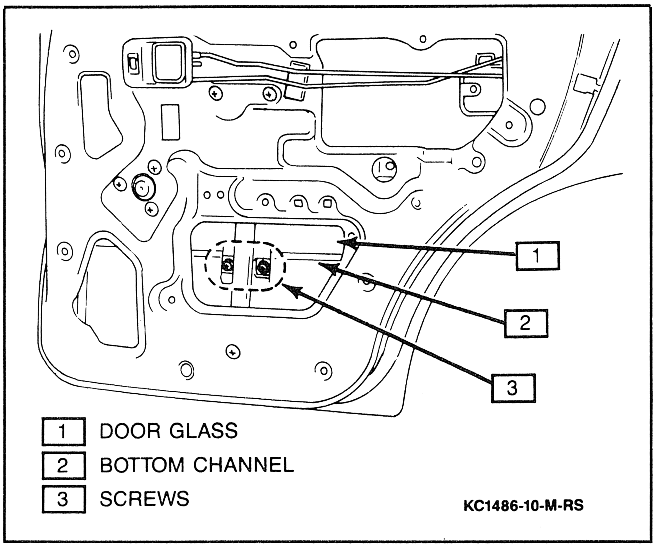

1
2
3
1 DOOR GLASS
2 BOTTOM CHANNEL
3 SCREWS
KC1486-10-M-RS

Figure 27 Rear Glass Channel Attaching Screws

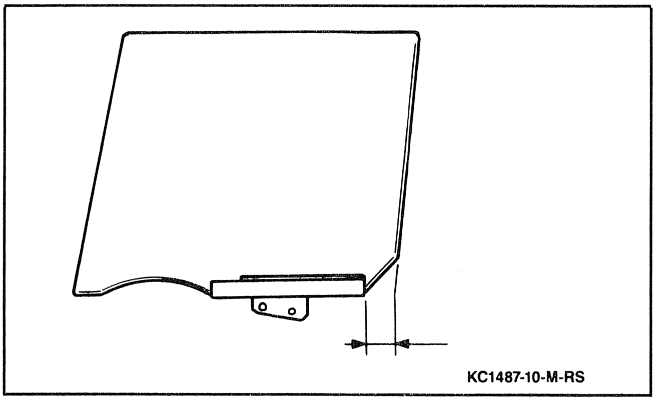

KC1487-10-M-RS

Figure 28 Rear Glass Bottom Channel Specification

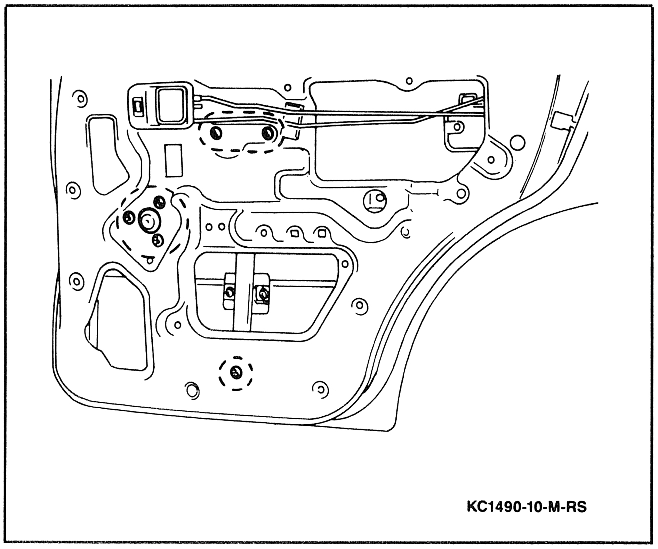

KC1490-10-M-RS

Figure 29 Rear Window Regulator Attaching Screws

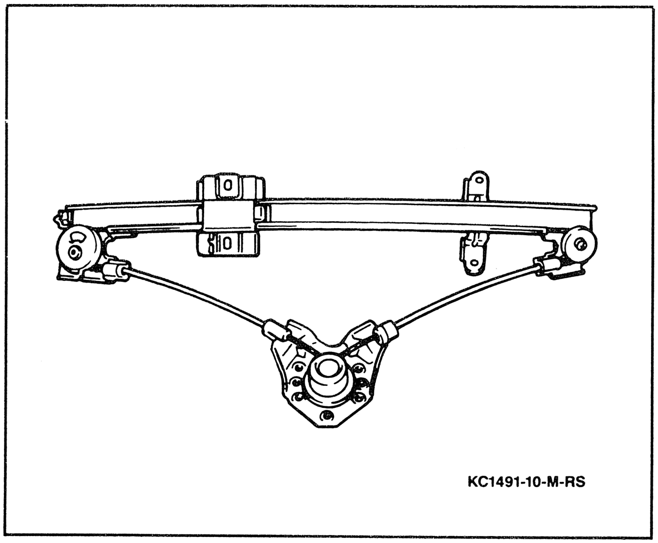

KC1491-10-M-RS

Figure 30 Rear Window Regulator

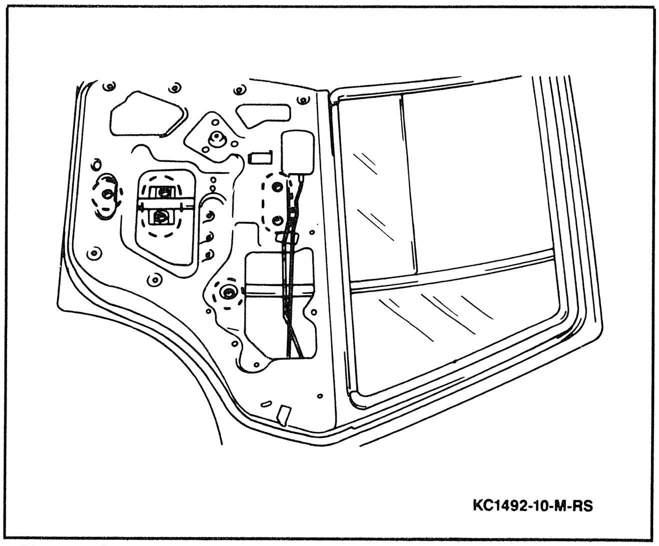

KC1492-10-M-RS

Figure 31 Rear Window Regulator Assembly Screws

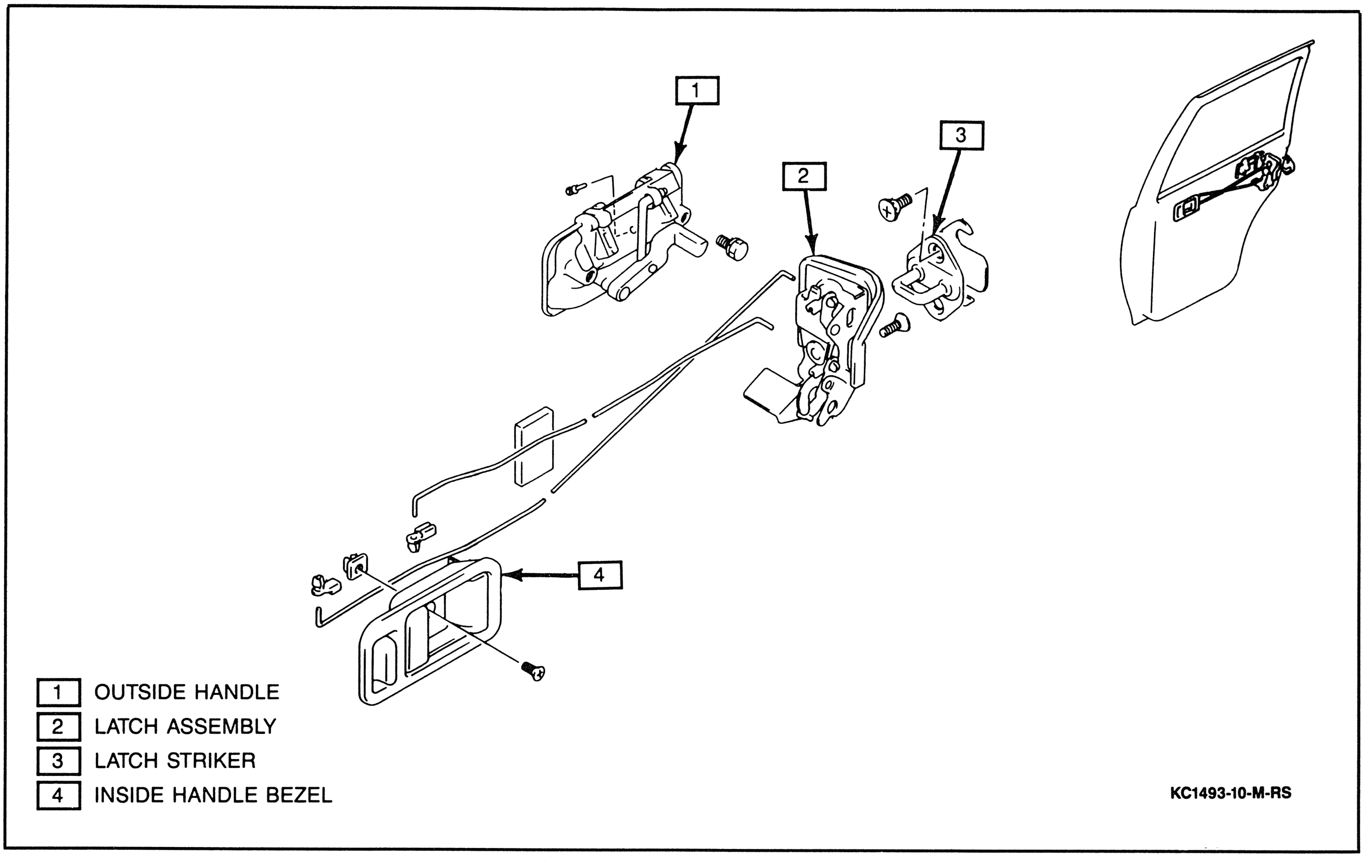

1
2
3
4
1 OUTSIDE HANDLE
2 LATCH ASSEMBLY
3 LATCH STRIKER
4 INSIDE HANDLE BEZEL
KC1493-10-M-RS

Figure 32 Rear Door Lock Assembly

SECTION 10-6

BODY REAR QUARTERS

CONTENTS

BODY SIDE MOLDINGS 10-6-1
Rear Quarter Window Molding 10-6-1
REAR SEAT SIDE MOLDING 10-6-1
Rear Quarter Window Weatherstrip 10-6-1
Rear Storage Compartment Side Molding 10-6-2
FUEL FILLER DOOR 10-6-2

BODY SIDE MOLDINGS

The optional body side moldings are installed with adhesive. Make sure that both bonding surfaces are clean and free of dirt and oil.

If adequate adhesive force is not obtainable, use a urethane adhesive (Figures 1 and 2).

Rear Quarter Window Moldings

(Optional)

The rear quarter window moldings are installed with adhesive, identical to the body side moldings.

REAR SEAT SIDE MOLDING

3 Door Model

↔ Remove or Disconnect

1. Removal of rear seat cushion and back are not necessary.
2. Loosen bottom of rear quarter window lace.
3. Three cross-recess screws at rear of molding.
4. One plastic fastener on rear compartment floor; two under arm rest.
5. Molding.

→← Install or Connect

1. Molding.
2. Three screws and three plastic fasteners.
3. Rear quarter window lace.

REAR QUARTER WINDOW WEATHERSTRIP

3 Door Model

↔ Remove or Disconnect

1. Window latch from body (one bolt).
2. Quarter window glass. Refer to STATIONARY GLASS (Section 10-2).
3. Weatherstrip.

→← Install or Connect

1. Weatherstrip to window opening.
2. Quarter window glass.
3. Window latch to body.

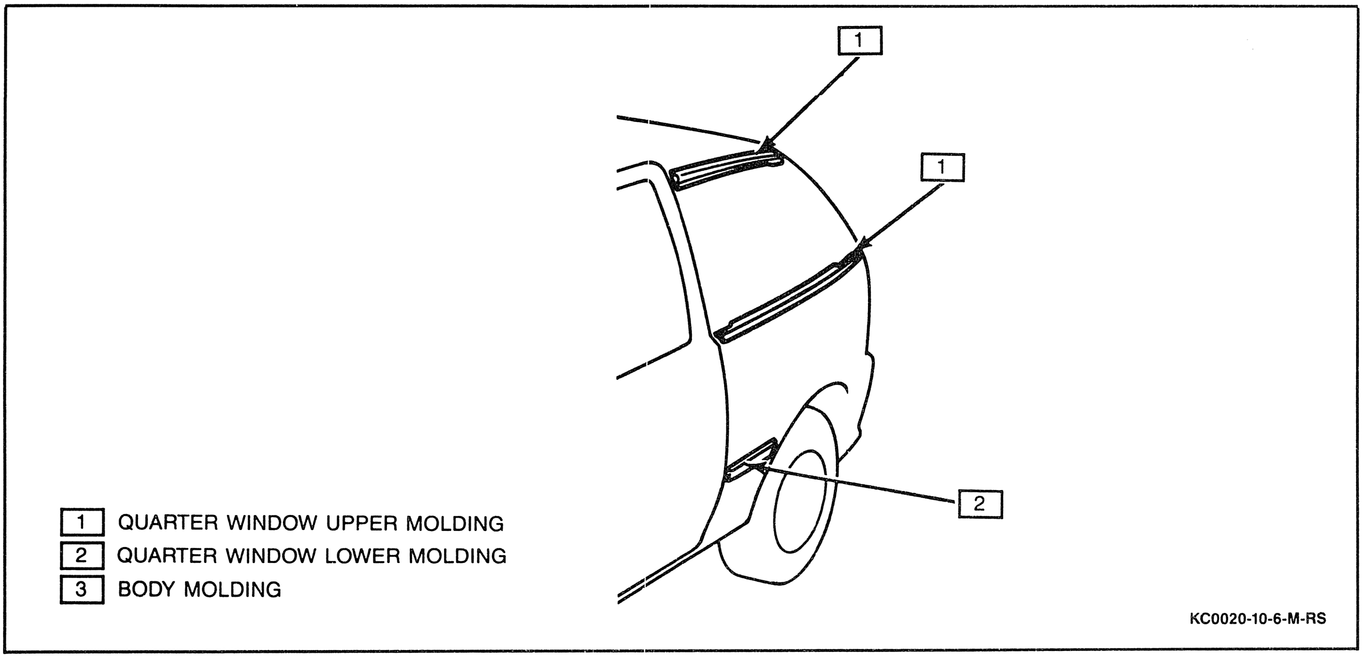

1
1
2
1 QUARTER WINDOW UPPER MOLDING
2 QUARTER WINDOW LOWER MOLDING
3 BODY MOLDING
KC0020-10-6-M-RS

Figure 1 Rear Window Molding - 3 Door Model

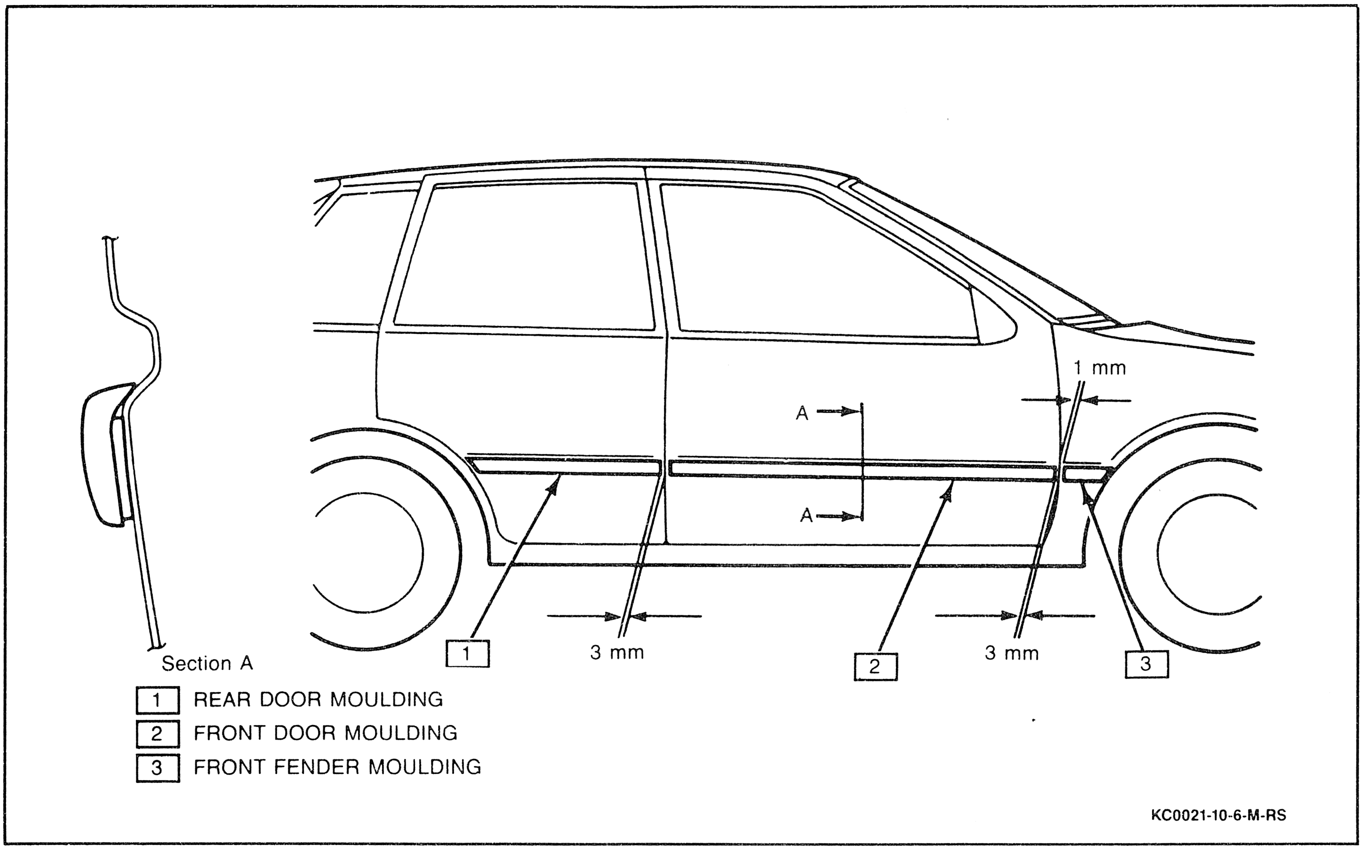

1 mm
A
A
Section A
1
3 mm
2
3 mm
3
1 REAR DOOR MOULDING
2 FRONT DOOR MOULDING
3 FRONT FENDER MOULDING
KC0021-10-6-M-RS

Figure 2 Body Side Molding - 5 Door Model

REAR STORAGE COMPARTMENT SIDE MOLDING

↔ Remove or Disconnect

1. Loosen rear storage compartment carpeting.
2. Rear end trim molding.
3. Two screws securing back seat molding.
4. Four plastic fasteners.
5. Molding.

→← Install or Connect

1. Molding.
2. Four plastic fasteners.
3. Two screws.
4. Rear end trim molding.
5. Rear compartment carpeting.

FUEL FILLER DOOR

↔ Remove or Disconnect

1. Two cross-recess bolts securing door.
2. Fuel filler door.

→← Install or Connect

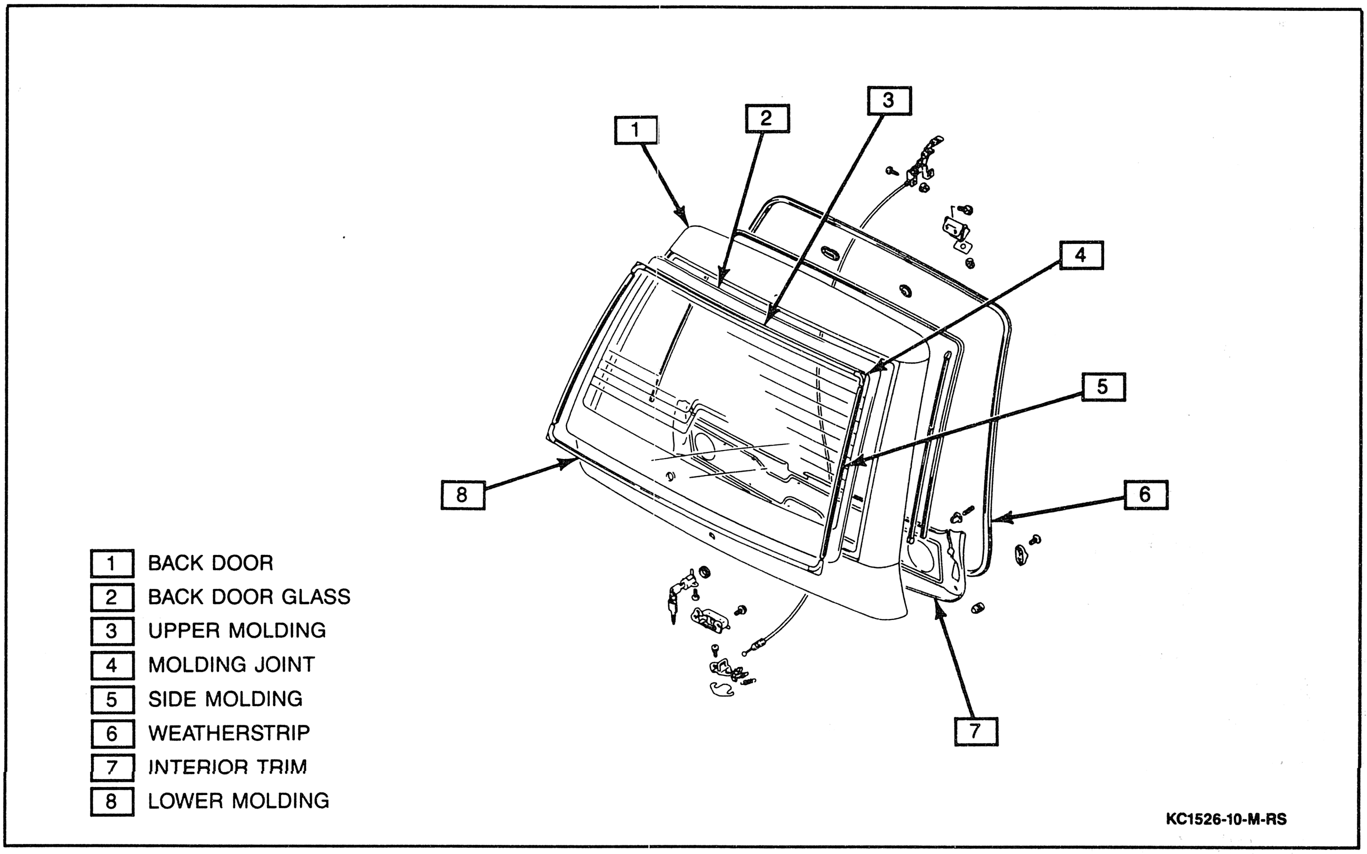
1. Fuel filler door.
2. Two bolts.

SECTION 10-7

BODY REAR END

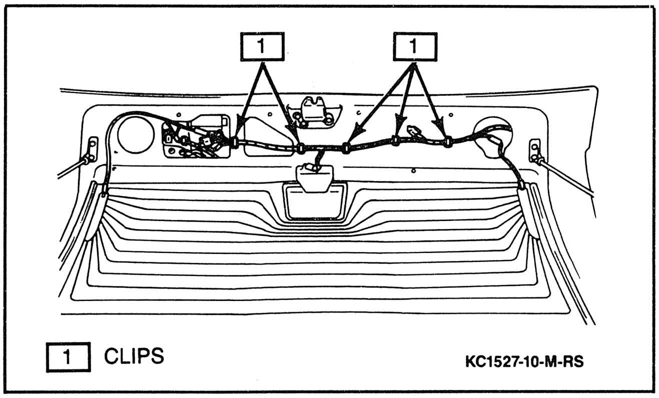
CONTENTS

Back Door 10-7-1
Back Door Supports 10-7-2
Back Door Weatherstrip 10-7-3
Center High-Mounted Stoplamp 10-7-3
Back Door Lock 10-7-3
Back Door Striker 10-7-3
Lock Cylinder 10-7-4



1
2
3
4
5
6
7
8
1 BACK DOOR
2 BACK DOOR GLASS
3 UPPER MOLDING
4 MOLDING JOINT
5 SIDE MOLDING
6 WEATHERSTRIP
7 INTERIOR TRIM
8 LOWER MOLDING
KC1526-10-M-RS

Figure 1 Back Door Assembly



1
1
1 CLIPS
KC1527-10-M-RS

Figure 2 Back Door Wiring Harness

BACK DOOR

Figures 1 through 6

↔ Remove or Disconnect

1. Back door interior trim (nine plastic trim fasteners).
2. Back door wiring harness. Disconnect harness from door by releasing five retaining clips. Pull harness out of door (Figure 2).
3. Rear windshield washer hose from door, if so equipped.
4. Back door support detach at door-end of support (two bolts each side).
5. Four door hinge bolts.
6. Back door.

Install or Connect

1. Four hinge bolts.
2. Door lift support.
3. Back door wiring harness; washer, if necessary.
4. Interior plastic trim.

Tighten

- All back door anchor bolts to 45 N·m (33 lb.ft.).

Adjust

- Adjust latch striker so that the striker shaft lines up with the center groove of the door lock assembly (Figure 3).
- To adjust the fit in a vertical direction, use shims under the striker as shown (Figures 3 and 4).
- Rubber cushions are located on each side of the back door base. They are screw-adjustable and can be used to help set door closure (Figure 5).

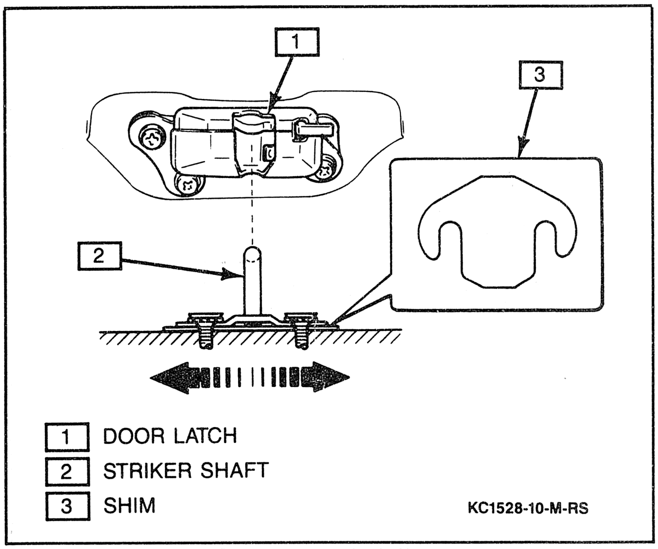

1
2
3
1 DOOR LATCH
2 STRIKER SHAFT
3 SHIM
KC1528-10-M-RS

Figure 3 Door Latch Adjustment

BACK DOOR SUPPORTS

Figures 6, 7, and 8

Remove or Disconnect

1. Back door interior trim panel (nine plastic trim fasteners).
2. Back door lift support two cross-recess bolts on door; one 12 mm nut on vehicle body.

Install or Connect

1. Prop door open.
2. Lift support on door and body.
3. Back door interior trim panel.

Tighten

- All back door anchor bolts to 45 N·m (33 lb.ft.).

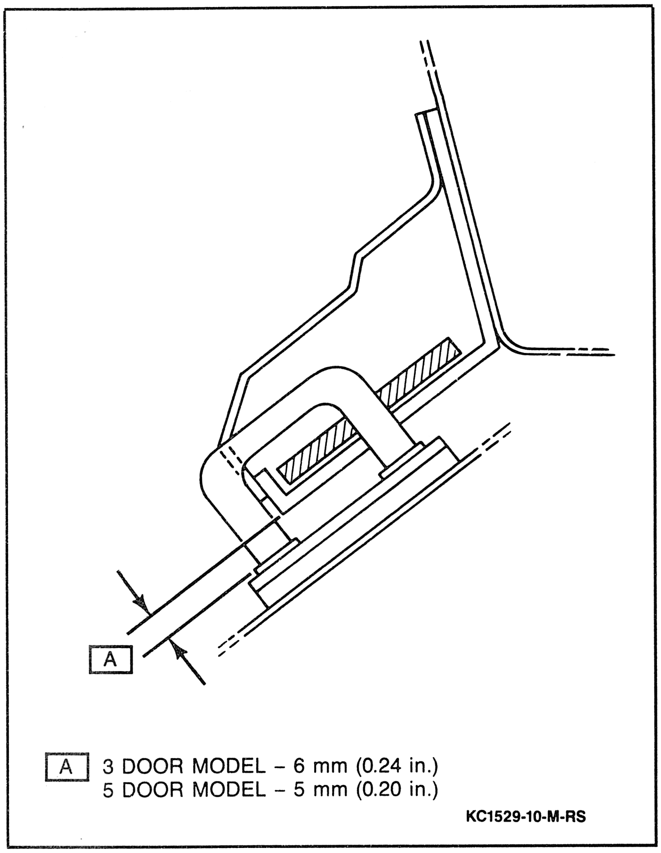

A
A 3 DOOR MODEL – 6 mm (0.24 in.)
5 DOOR MODEL – 5 mm (0.20 in.)
KC1529-10-M-RS

Figure 4 Striker/Lock Adjustment

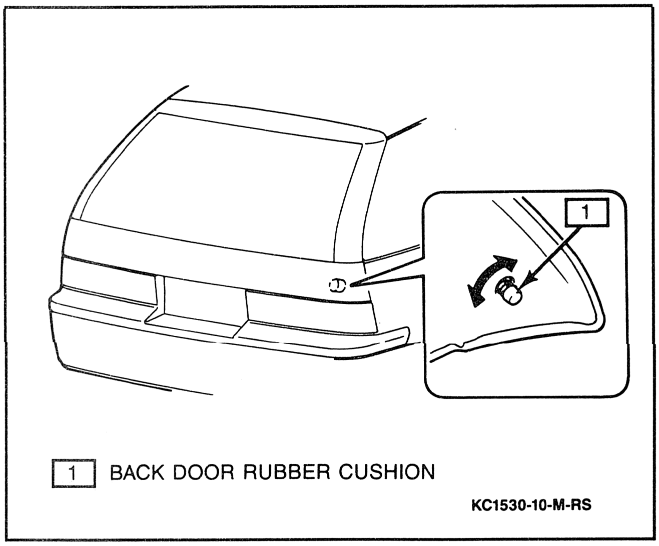

1
1 BACK DOOR RUBBER CUSHION
KC1530-10-M-RS

Figure 5 Rubber Adjustment Cushion

Important

- Do not disassemble support as its cylinder is gas-filled.
- When discarding an old support, wrap it in a vinyl bag as shown. Use a 2 - 3 mm (0.08 - 0.12 in.) drill to make a hole, through bag into support (Figure 8).
- When installing a new lift support, be very careful not to scratch its surface, and never allow dirt or oil to contact its surface.

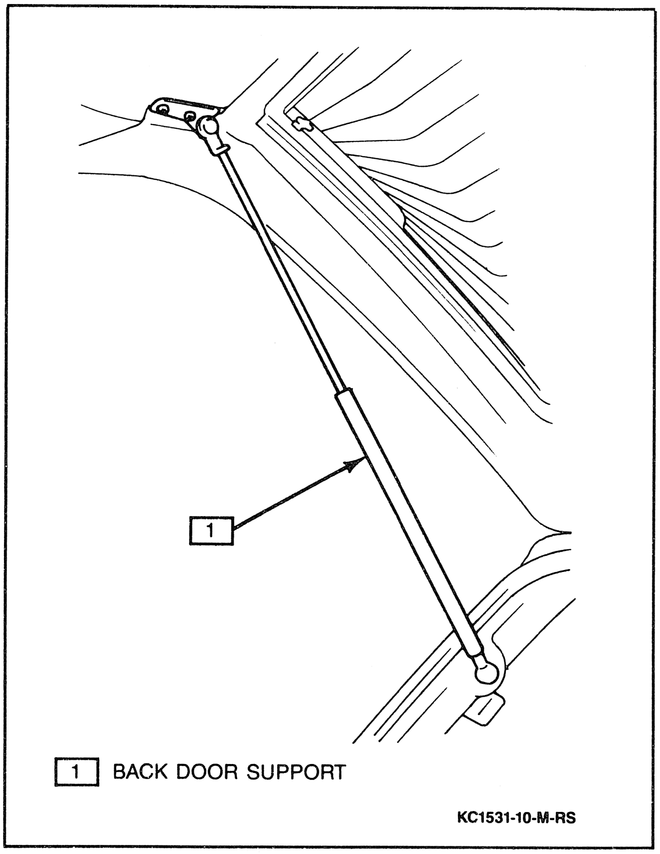


Figure 6 Back Door Lift Support

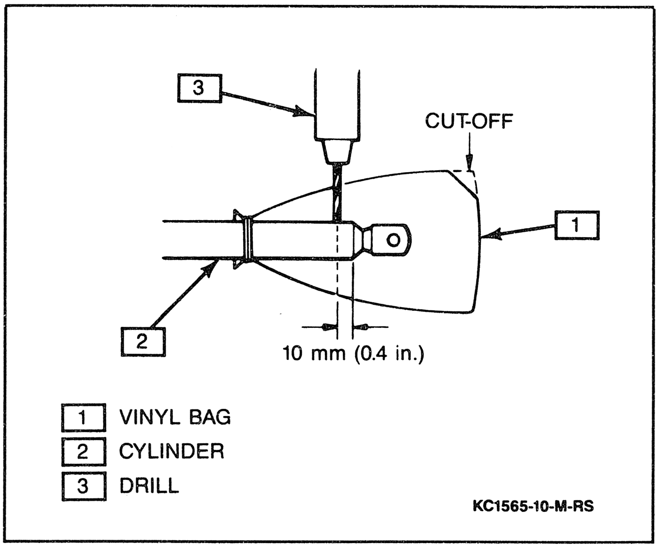


Figure 8 Discarding Cylinder

BACK DOOR WEATHERSTRIP

The back door weatherstrip is a one-piece, continuous rubber strip that fits over the back door opening flange. To remove, simply pull off and cut. To install, prop door open and disconnect one end of lift support mechanisms (the body attachment side is quicker, as there is no trim which requires removal). Slip the new weatherstrip around the detached supports and onto the flange. Reattach supports and check for water leakage.

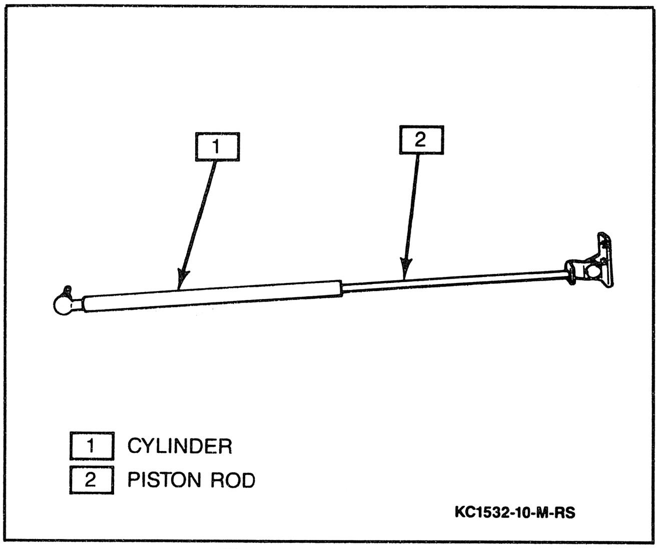


Figure 7 Support

Name Plates

The name plates “Metro” and “Geo” are adhesive decals and can be peeled off and replaced.

CENTER HIGH-MOUNTED STOPLAMP

Remove or Disconnect

1. Back door interior trim panel.
2. Two cross-recess bolts.
3. Wiring harness connection.
4. High-mounted stoplamp.

Install or Connect

1. Wiring harness connection.
2. Two bolts securing lamp.
3. Back door interior trim panel.

BACK DOOR LOCK

Figure 3

Remove or Disconnect

1. Back door interior trim panel.
2. Three cross-recess bolts.
3. Lock mechanism.

Install or Connect

1. Three bolts securing lock mechanism.
2. Back door interior trim panel.

BACK DOOR STRIKER

Remove or Disconnect

1. Back door interior trim panel.
2. Two cross-recess bolts.
3. Striker.

Install or Connect

1. Two bolts securing striker.

2. Back door trim panel.

LOCK CYLINDER

↔ Remove or Disconnect

1. Back door interior trim panel.
2. Rear door lock mechanism.
3. Two cross-recess bolts securing cylinder.
4. Lock cylinder.

→← Install or Connect

1. Two bolts securing cylinder.
2. Three bolts securing lock mechanism.
3. Back door interior trim panel.

TORQUE SPECIFICATIONS

All Rear Door Bolts	45 N·m (33 lb.ft.)

SECTION 10-8

ROOF

CONTENTS

Sun Visors 10-8-1
Domelamp 10-8-1
Windshield Pillar Garnish Molding 10-8-1
Head Lining 10-8-1

SUN VISORS

Remove or Disconnect

1. Two cross-recess screws securing each visor.
2. One cross-recess screw securing the inner support clips.
3. Sun visors.

Install or Connect

1. Sun visors.
2. One cross-recess screw securing the inner support.
3. Two cross-recess screws securing each visor.

DOMELAMP

Remove or Disconnect

1. Forward cover plate (pull off).
2. Two outer cross-recess screws from assembly.
3. Leave domelamp assembly dangling at this point. The electrical connection cannot be detached until the head lining is loosened at the front.

Install or Connect

1. Electrical wiring and head lining.
2. Two cross-recess screws.
3. Forward cover plate.

WINDSHIELD PILLAR GARNISH MOLDING

This molding extends from the sides of the dashboard along the front windshield upward to the roof of the vehicle. It snaps into place and fits under the door opening lace. The garnish is easily removed by hand.

HEAD LINING

Figures 1 through 4

Remove or Disconnect

1. Left and right sun visor and inner supports.
2. Rearview mirror.
3. Domelamp. Leave lamp dangling until head lining is removed.
4. Right and left windshield garnishes.
5. Pull off finishing laces from door openings, front window, quarter windows, and back glass.

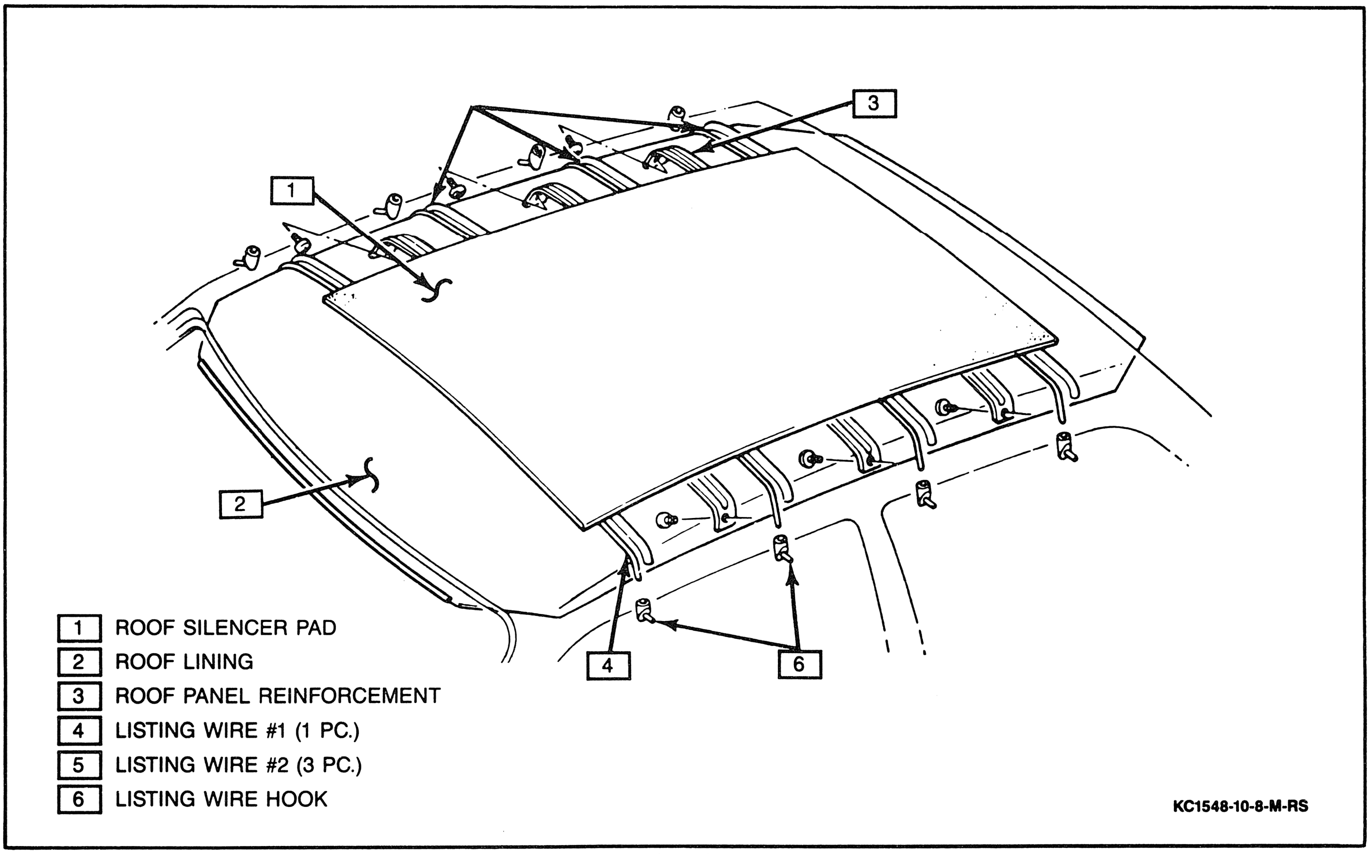

3
1
2
4
6
1 ROOF SILENCER PAD
2 ROOF LINING
3 ROOF PANEL REINFORCEMENT
4 LISTING WIRE #1 (1 PC.)
5 LISTING WIRE #2 (3 PC.)
6 LISTING WIRE HOOK
KC1548-10-8-M-RS

Figure 1 Head Lining Assembly

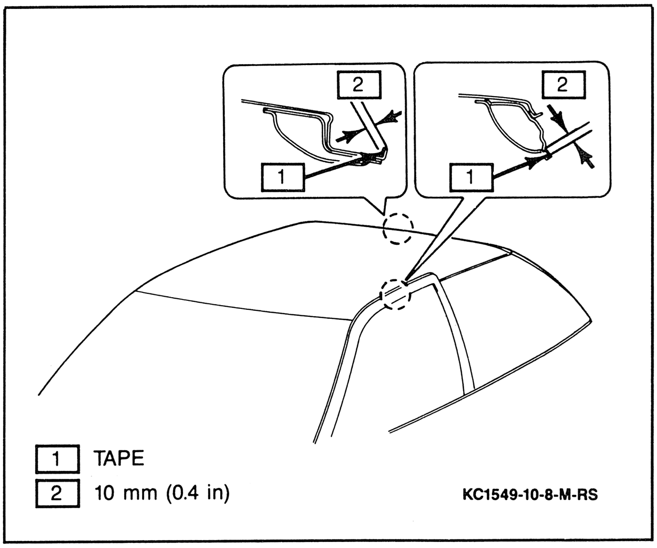

2
2
1
1
1 TAPE
2 10 mm (0.4 in)
KC1549-10-8-M-RS

Figure 2 Two-Sided Bondable Tape

6. Head liner and four listing wires.

Important

- The front wire is longer than the other three.

7. Adhesive tape.

Install or Connect

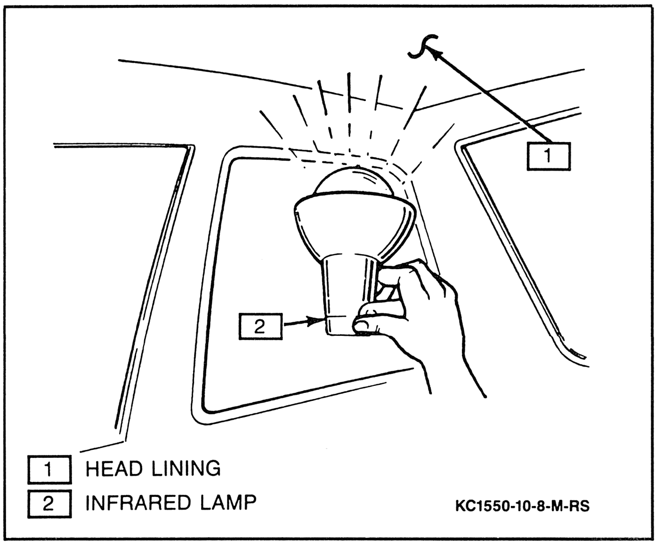

1
2
1 HEAD LINING
2 INFRARED LAMP
KC1550-10-8-M-RS

Figure 3 Head Lining Wrinkle Removal

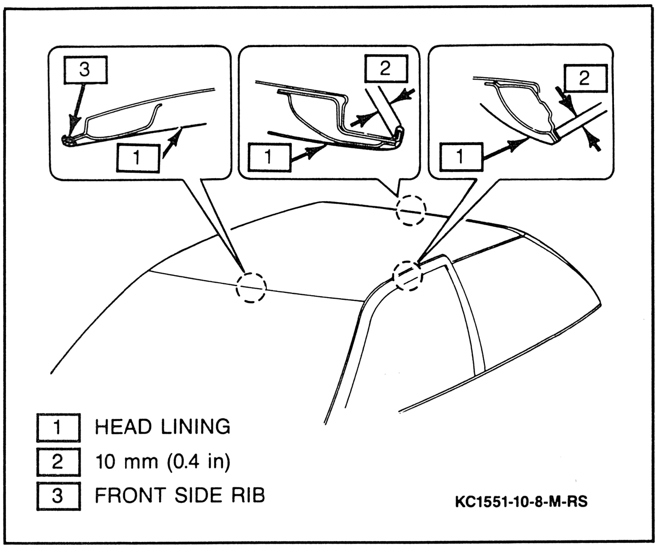

3
2
2
1
1
1
1 HEAD LINING
2 10 mm (0.4 in)
3 FRONT SIDE RIB
KC1551-10-8-M-RS

Figure 4 Head Lining to Flange Overlap

Clean

- Adhesive residue from flange and finishing laces with solvent.

1. Two-sided bondable tape to upper side of each flange (Figures 2 and 4). Tape should be affixed no further than 10 mm (0.4 in.) from the end of the flange.
2. Domelamp wires through hole in lining, connecting domelamp.
3. Listing wires and lining.
4. Windshield garnishes.
5. Door-opening lace. Windshield, back glass and quarter glass finishing laces.
6. Use an infrared lamp to warm up the roof lining for 30 to 60 seconds; This will remove any wrinkles that may have developed (Figure 3).

NOTICE: Use infrared lamp for as short a duration as is necessary.

7. Domelamp, sun visors and inner supports, rearview mirror.

Important

- Pull the roof lining free from wrinkles and adhere to the two-sided bondable tape. Make sure lining is wrinkle-free when installing around center pillar.

SECTION 10-9

SEATS

CONTENTS

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FRONT BUCKET SEATS

Figure 1

Remove or Disconnect

1. Five seat rail mounting bolts.
2. Front bucket seat as a whole.

Install or Connect

1. Front bucket seats.
2. Five seat rail mounting bolts.

Tighten

- Front seat mounting bolts to 18 N·m (13 lb. ft.).

SEAT BACK COVER AND CUSHION COVER

Figure 1

Remove or Disconnect

1. Five C-rings from lower perimeter of front seat back.
2. Roll up cover, slowly and evenly, from seat bottom.

Important

- The fit is very tight.

3. To remove lower cushion cover: remove C-rings from lower perimeter of cushion using C-ring pliers. Pull up sides of cover. The top of the cover is bonded to the seat's foam pad--use care removing the cover so not to damage the foam.

Install or Connect

1. Roll cover down seatback from top.
2. Five C-rings at bottom of seat back using C-ring pliers.
3. To install cushion cover: bond cover to top of cushion using trim cement.
4. C-rings along lower perimeter of seat cushion using C-ring pliers.

Head Restraint

The restraint is an intergral part of the seat back and is not servicable.

RECLINER MECHANISM

Figure 1

Remove or Disconnect

1. Pressed-on recliner actuator handle.
2. Two cross-recess bolts securing seat side panel.
3. Loosen seat back cover and trim pad to gain access to the two actuator bolts.
4. Five bolts; two on seat back, three on seat cushion.
5. Easy entry cable.
6. Recliner mechanism.

Install or Connect

1. Five bolts that secure recliner mechanism; three on lower cushion, two on seat back.

   Tighten

   - Bolts to 18 N·m (13 lb.ft.)

2. Easy entry cable.
3. Seat back cover, including C rings at lower perimeter.
4. Seat side cover.
5. Press on recliner actuator handle.

SEAT ADJUSTERS

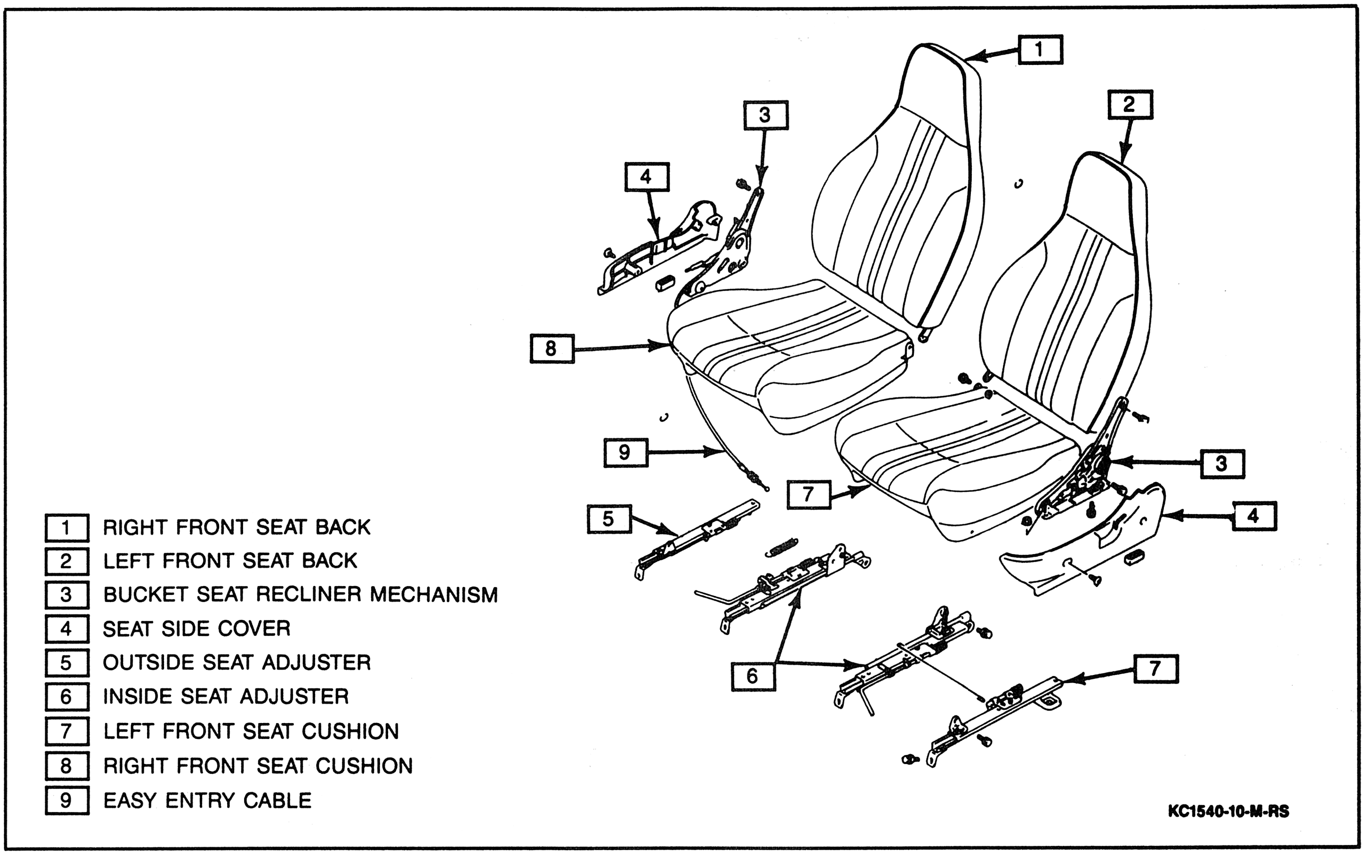
Figure 1

Remove or Disconnect

1. Bucket seat from car.
2. Pressed-on recliner actuator handle.
3. Side panel and easy entry cable.
4. Seat adjuster and rails from beneath seat.

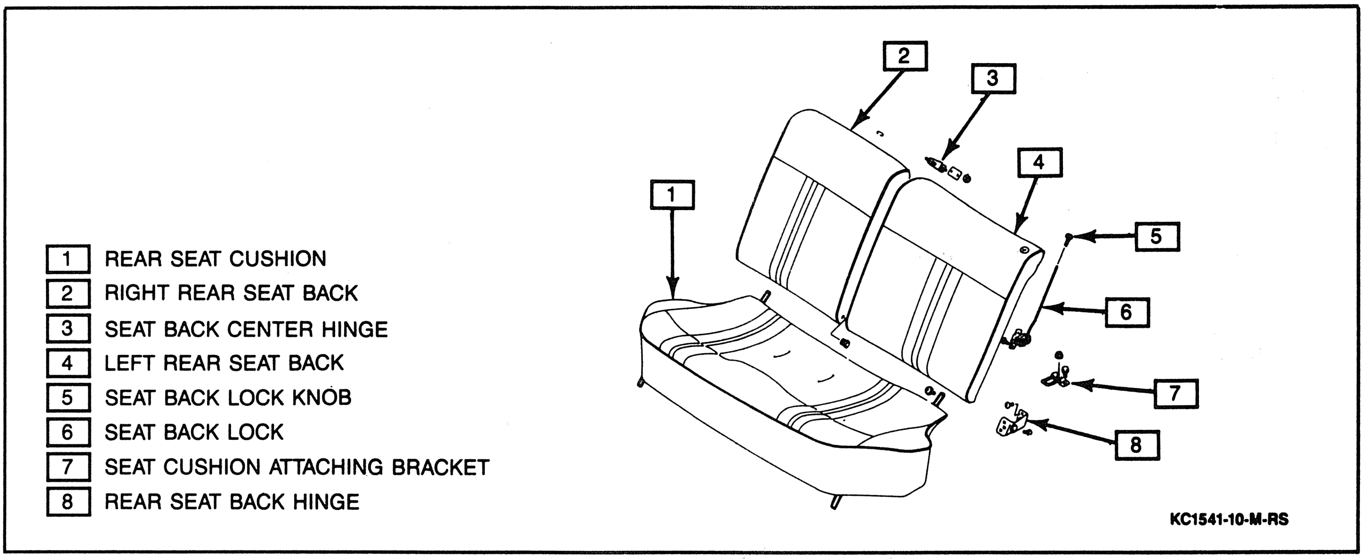
Install or Connect

1. Lubricate seat adjuster rails with GM Luberplate.
2. Seat adjuster to bottom of seat.
3. Easy entry cable and side panel.
4. Press on recliner actuator handle.
5. Bucket seat.



1 RIGHT FRONT SEAT BACK
2 LEFT FRONT SEAT BACK
3 BUCKET SEAT RECLINER MECHANISM
4 SEAT SIDE COVER
5 OUTSIDE SEAT ADJUSTER
6 INSIDE SEAT ADJUSTER
7 LEFT FRONT SEAT CUSHION
8 RIGHT FRONT SEAT CUSHION
9 EASY ENTRY CABLE

Figure 1 Front Seat Assembly



1 REAR SEAT CUSHION
2 RIGHT REAR SEAT BACK
3 SEAT BACK CENTER HINGE
4 LEFT REAR SEAT BACK
5 SEAT BACK LOCK KNOB
6 SEAT BACK LOCK
7 SEAT CUSHION ATTACHING BRACKET
8 REAR SEAT BACK HINGE

Figure 2 Rear Seat Assembly

Tighten

- Tighten all bolts to 18 N·m (13 lb.ft.).

REAR SEATS

REAR SEAT BACK

Figures 2 and 3

Remove or Disconnect

1. From trunk, disengage folding seat lock and push seat back forward.
2. Fourteen retainers to loosen carpet on posterior side of seat back and loosen floor cover.
3. Four cross-recess attaching bolts (six bolts with split rear seat).

Install or Connect

1. Four (six with split seat) attaching bolts to secure seat back.
2. Floor cover and carpeting in trunk area.
3. Lock seat back into upright position.

Tighten

- All bolts to 18 N·m (13 lb.ft.)

REAR SEAT CUSHION

Figure 4

Remove or Disconnect

1. Loosen trunk floor and carpeting on lower perimeter of seat back.
2. From trunk, remove seat cushion attaching screws (Two cross-recess screws) (Figure 4).

NOTICE: On the five door model, the rear seat back must be removed to access these screws.

3. From the passenger compartment, lift up front of cushion and remove (Figure 4).

Install or Connect

1. Seat cushion.
2. Attaching screws on trunk floor.
3. Floor covering and trunk compartment carpeting.

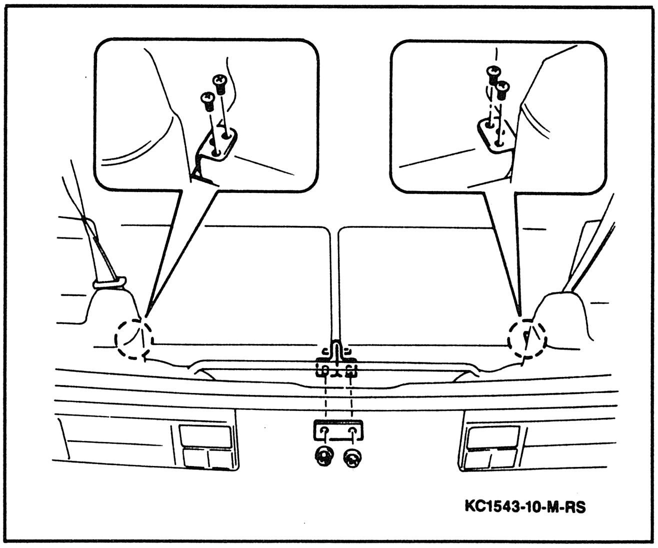
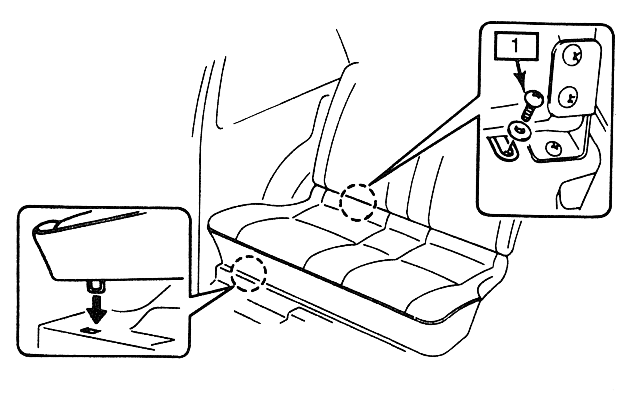


Figure 3 Rear Seat Removal



1 SEAT CUSHION ATTACHING SCREW—RIGHT SIDE (VIEW IS FROM TRUNK)

Figure 4 Rear Seat Cushion Removal

Tighten

- All bolts to 18 N·m (13 lb.ft.).

FOLDING LOCKS

Remove or Disconnect

1. Rear seat back.
2. On work bench, loosen trim cover.
3. Locking knob.
4. Shave seat cushion padding from side of seat back.
5. Folding lock.

Install or Connect

1. Folding lock mechanism.
2. Replace trim padding in lock area.
3. Locking knob.
4. Seat back trim cover.
5. Seat back in vehicle.

TRIM AND COVERS

The rear seat covers are similar to the front seat covers. To remove the seat back cover: Remove seat back from vehicle and loosen trim cover from all sides.

The rear seat cushion is more involved. After removing the cushion from the vehicle, disconnect C-rings at lower perimeter of seat cushion. The tip area of the cover is bonded to the foam pad; this glued section measures 4.9x15 in. Take care when removing this cover not to pull off any of the foam with the dried adhesive. When replacing covers, make sure the fit is as tight as possible.

TORQUE SPECIFICATION

Tighten all bolts .... 18 N·m (13 lb.ft.)

SECTION 10-10

SAFETY BELTS

NOTICE: When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are not reused, and those requiring thread locking compound, will be called out. The correct torque value must be used when installing fasteners that require it. If the above conditions are not followed, parts or system damage could result.

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GENERAL DESCRIPTION

AUTOMATIC (PASSIVE) FRONT SAFETY BELTS

Figure 1

The automatic (passive) front safety belts are automatically set into place when the driver and/or passenger sits in a front seat and closes the door. They are automatically released when the door is opened. Thus neither buckling nor unbuckling is required.

Belt Retractor

Figure 2

The front safety belts have a system to cancel the lock function of the retractor, allowing the door to be opened smoothly. When a door is opened, both the door latch switch and the door switch close. When these switches are closed, the control module relay is energized and battery voltage is applied to the retractor solenoid.

Warning Lamps

Figures 3 and 4

Three lamps are provided with the automatic front safety belts. The driver's and passenger's safety belt reminder lamps are found on either side of the steering column. They warn the driver or passenger that their safety belt cannot provide proper restraint due to the belt being unbuckled or system failure. The door warning lamp is located in the instrument panel cluster and alerts the driver or passenger that a door is not closed tightly.

CAUTION: The automatic safety belt may fail to provide proper restraint if, after the belt has been buckled and the door has been completely closed, any of the following conditions exist:

- Warning lamp does not operate at all.
- Warning lamp remains on or flashing.

Driving vehicle with the safety belt in an ineffective state may cause personal injury to the driver or passenger.

Switches

Figure 4

The following switches are incorporated into the automatic safety belt system:

- A safety belt switch is located in each safety belt buckle.
- Door switches are located in the lower rear door jambs.
- Door latch switches are installed in each door latch.
- The warning lamp check switch is built into the ignition switch.

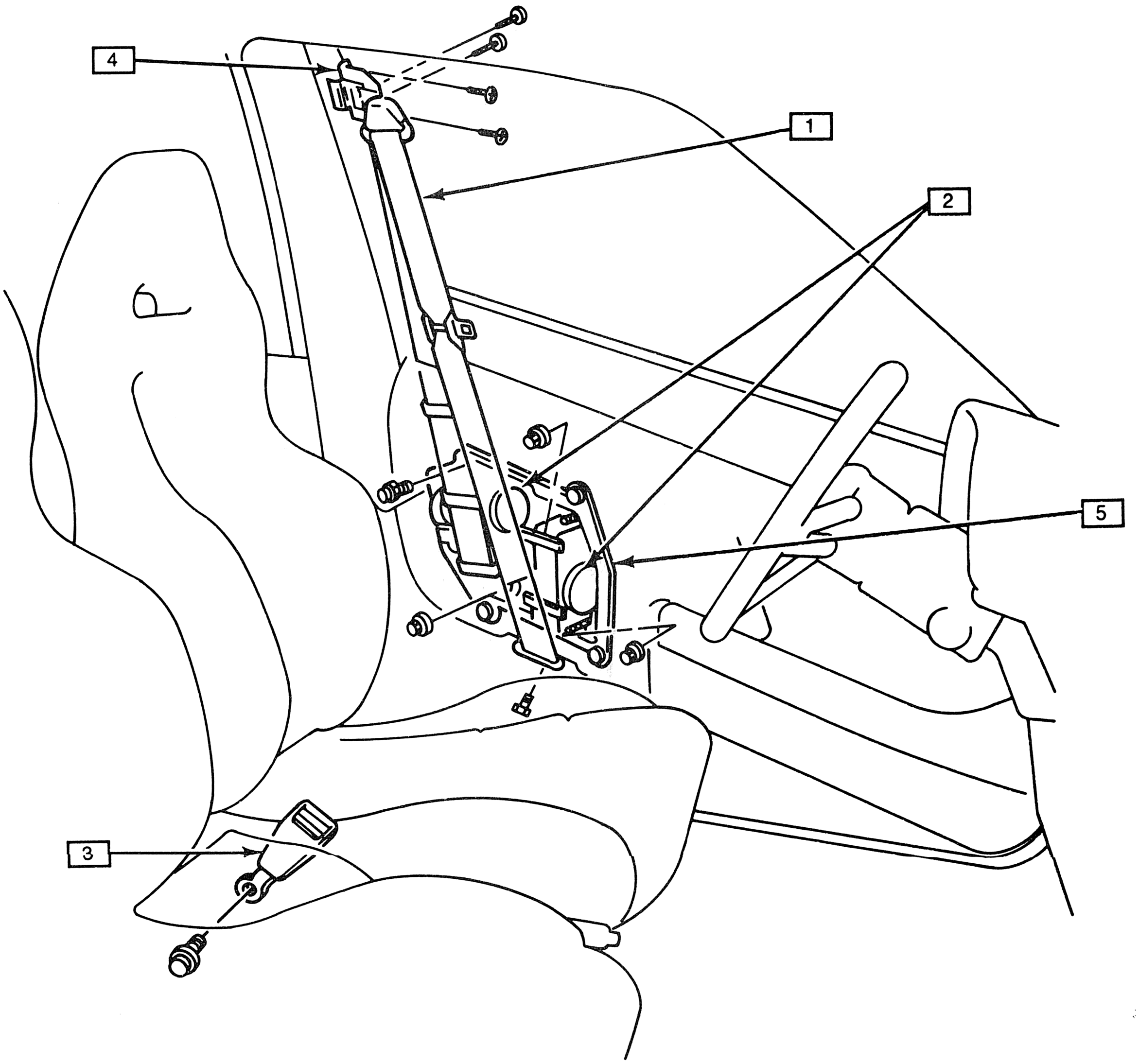
REAR SAFETY BELTS

The shoulder harnesses found in the rear seat are equipped with Emergency and Auto Locking Retractors (E-ALR). The E-ALR system will lock the safety belt webbing under the following conditions:

- When the belt is pulled rapidly from the retractor.
- When the vehicle is accelerating or decelerating.
- When the vehicle is inclined.
- If the webbing is pulled all the way out and then allowed to retract. At this time the system will not allow the webbing to be pulled out any further until it is retracted fully.

Important

- Keep sharp objects and potentially damaging objects away from belts.



1 SAFETY BELT
2 RETRACTORS
3 BUCKLE
4 SAFETY BELT CONNECTOR BRACKET
5 RETRACTOR BRACKET

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Figure 1 Driver's Automatic Safety Belt

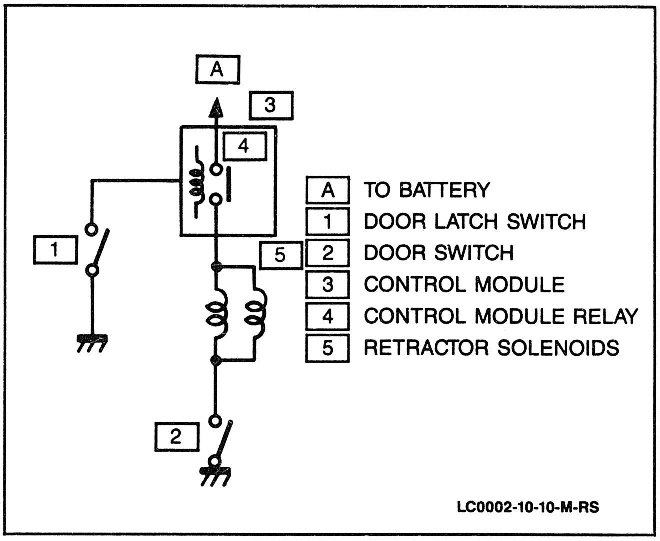

Figure 2 Retractor Circuit

- Avoid bending or damaging any portion of the buckle or latch plate.
- Do not bleach or dye belt webbing; use only mild soap and water.
- When installing safety belt anchor bolts, start bolts by hand to prevent cross-threading.
- Do not attempt any repairs on retractor mechanisms or covers. Replace defective assemblies with new ones.
- Replace any belts that are cut or damaged in any way.
- Do not install anything in trim panel which will obstruct the movement of safety belt.

DIAGNOSIS

Figures 5 through 14

Inspect

- All safety belt anchor bolts to verify that they are secure.
- Safety belt buckle, making sure it locks and unlocks easily.
- After inserting latch into buckle, tug sharply on belt, checking that the buckle remains locked.
- Fully extend shoulder belt to make sure there are no twists or tears in it.
- Allow the shoulder belt to fully retract, making sure it does so easily.

Running Test (E-ALR Safety Belts)

1. Fasten safety belt.
2. Drive vehicle at 16 km/h (10 mph) and apply brakes firmly.
3. Verify that the safety belt locks and does not allow your body to move forward.

   CAUTION: Conduct this test only in a safe area. Do not conduct test on the open road. A large empty parking lot is much more suitable.
4. If the belt does not lock during the running test, remove retractor and perform the static test.

Static Test

1. Remove retractor assembly.
2. Tilt the retractor slowly.
3. Verify that the belt can be pulled out of the retractor at an inclination of 15 degrees or less and that it cannot be pulled out at over 45 degrees of inclination.

ON-VEHICLE SERVICE

SAFETY BELT ASSEMBLY

Figure 8

Remove or Disconnect

1. Door panel.
2. Shoulder belt and then shoulder bracket.
3. Lap belt anchor bolt.
4. Retractor lead wire at connector.
5. Retractor fixing bolt and nuts, and then safety belt assembly.

Condition		Driver's safety belt reminder lamp	Passenger's safety belt reminder lamp	Door warning lamp	Buzzer
Driver's safety belt not buckled	Driver's safety belt switch CLOSED	ON			Sounds when warning lamp turns ON or flashes for 4 to 8 seconds immediately after ignition switch is turned to "RUN"
Passenger's safety belt not buckled	Passenger's safety belt switch CLOSED		ON		
Driver's door open or halfway open	Driver's door switch CLOSED and retractor lock function cancelled	ON		ON	
Passenger's door open or halfway open	Passenger's door switch CLOSED and retractor lock function cancelled		ON	ON	

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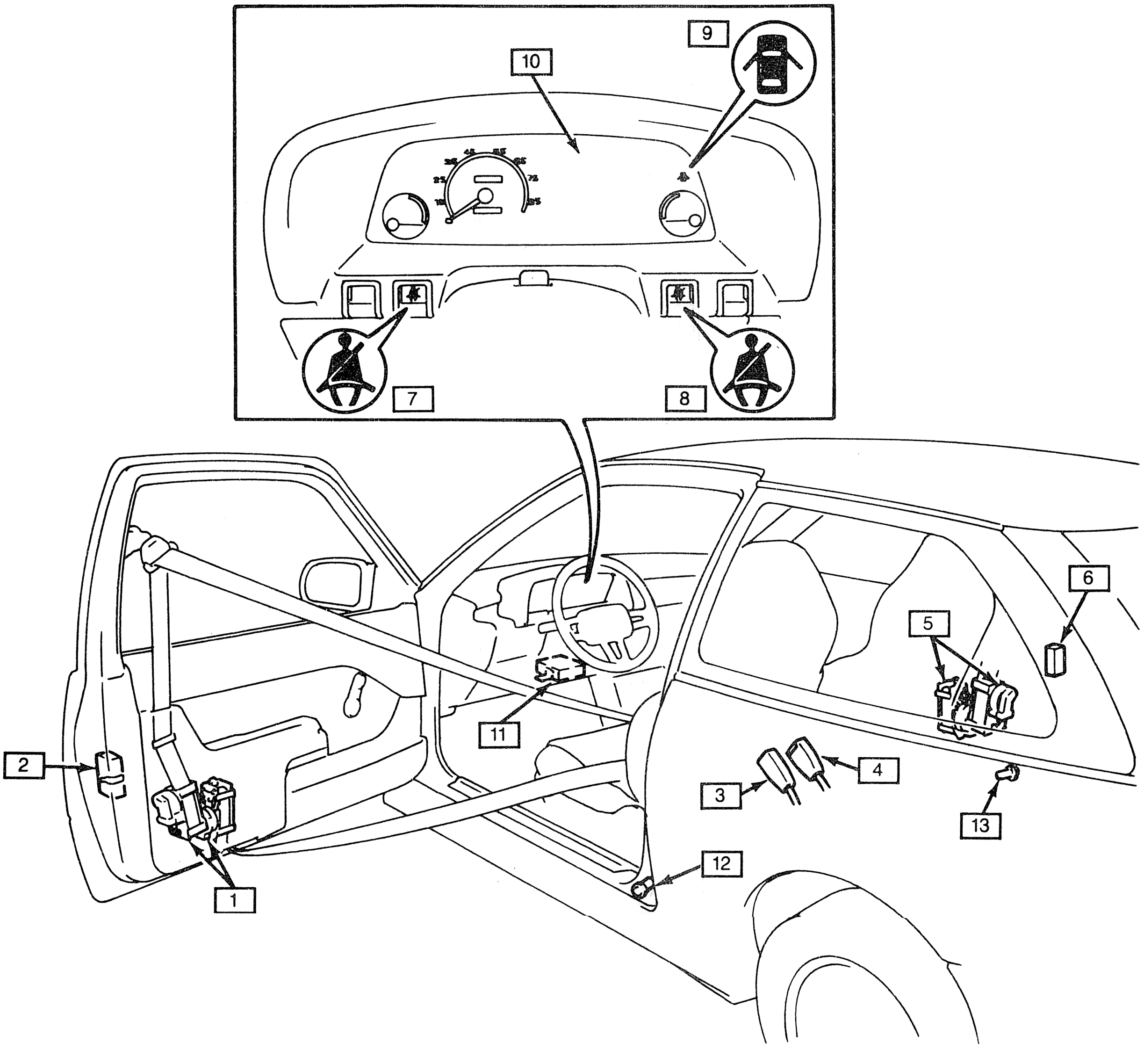
Figure 3 Warning Lamps Operation Chart



1 DRIVER'S SAFETY BELT RETRACTORS (WITH SOLENOID AND CANCEL SENSOR SWITCH)
2 DRIVER'S LATCH SWITCH
3 DRIVER'S SAFETY BELT SWITCH
4 PASSENGER'S SAFETY BELT SWITCH
5 PASSENGER'S SAFETY BELT RETRACTORS (WITH SOLENOID AND CANCEL SENSOR SWITCH)
6 PASSENGER'S LATCH SWITCH
7 DRIVER'S SAFETY BELT REMINDER LAMP
8 PASSENGER'S SAFETY BELT REMINDER LAMP
9 DOOR WARNING LAMP
10 INSTRUMENT PANEL
11 AUTOMATIC (PASSIVE) SAFETY BELT CONTROL MODULE
12 DRIVER'S DOOR SWITCH
13 PASSENGER'S DOOR SWITCH

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Figure 4 Component Parts Location

Problem	Possible Cause	Correction
Belt locks when door is opened.	• Battery over-discharged	• Charge battery.
	• Automatic seat belt control module fuse blown	• Repair and replace.
	• Control module power circuit or ground open	• Repair.
	• Door switch open	• Repair or replace.
	• Door latch switch open	• Repair or replace.
	• Safety belt retractor solenoid open	• Repair or replace.
	• Diode open	• Repair or replace.
	• Control module defective	• Replace.
Safety belt cannot lock.	• Door switch and door latch switch shorted	• Repair or replace.
	• Safety belt retractor lock defective	• Replace.
	• Control module defective	• Replace.
Safety belt reminder lamp turns ON even when door is closed and safety belt is buckled.	• If safety belt cannot be locked, refer to above item.	
	• If safety belt can be locked,	
	• Lock cancel sensor switch open	• Repair or replace.
	• Negative (–) side of lamp shorted to chassis	• Repair or replace.
	• Warning lamp check switch shorted	• Repair or replace.
	• Control module defective	• Replace.
Door warning lamp stays ON or flashing even when door is closed.	• When ON	
	• Negative (–) side of lamp shorted to chassis	• Repair or replace.
	• Warning lamp check switch shorted	• Repair or replace.
	• When flashing	
	• Door switch shorted	• Repair or replace.
	• Whether ON or flashing, control module defective	• Replace.
Safety belt reminder lamp fails to turn ON or buzzer fails to sound even when safety belt is unbuckled.	• Safety belt switch open	• Repair or replace.
	• Fuse blown (15A or 20A fuse)	• Repair or replace.
	• Control module power circuit or ground open	• Repair.
	• Defective control module	• Replace.
Door warning lamp fails to flash or buzzer fails to sound even when door is opened.	• Door switch open	• Repair or replace.
	• Fuse blown (15A or 20A fuse)	• Repair or replace.
	• Control module power circuit or ground open	• Repair.
	• Defective control module	• Replace.
Safety belt reminder lamp and/or door warning lamp bulb cannot be checked.	• If there is any additional problem, refer to applicable item.	
	• Warning lamp bulb burnt out	• Replace.
	• Warning lamp check switch open	• Repair or replace.
	• Defective control module	• Replace.

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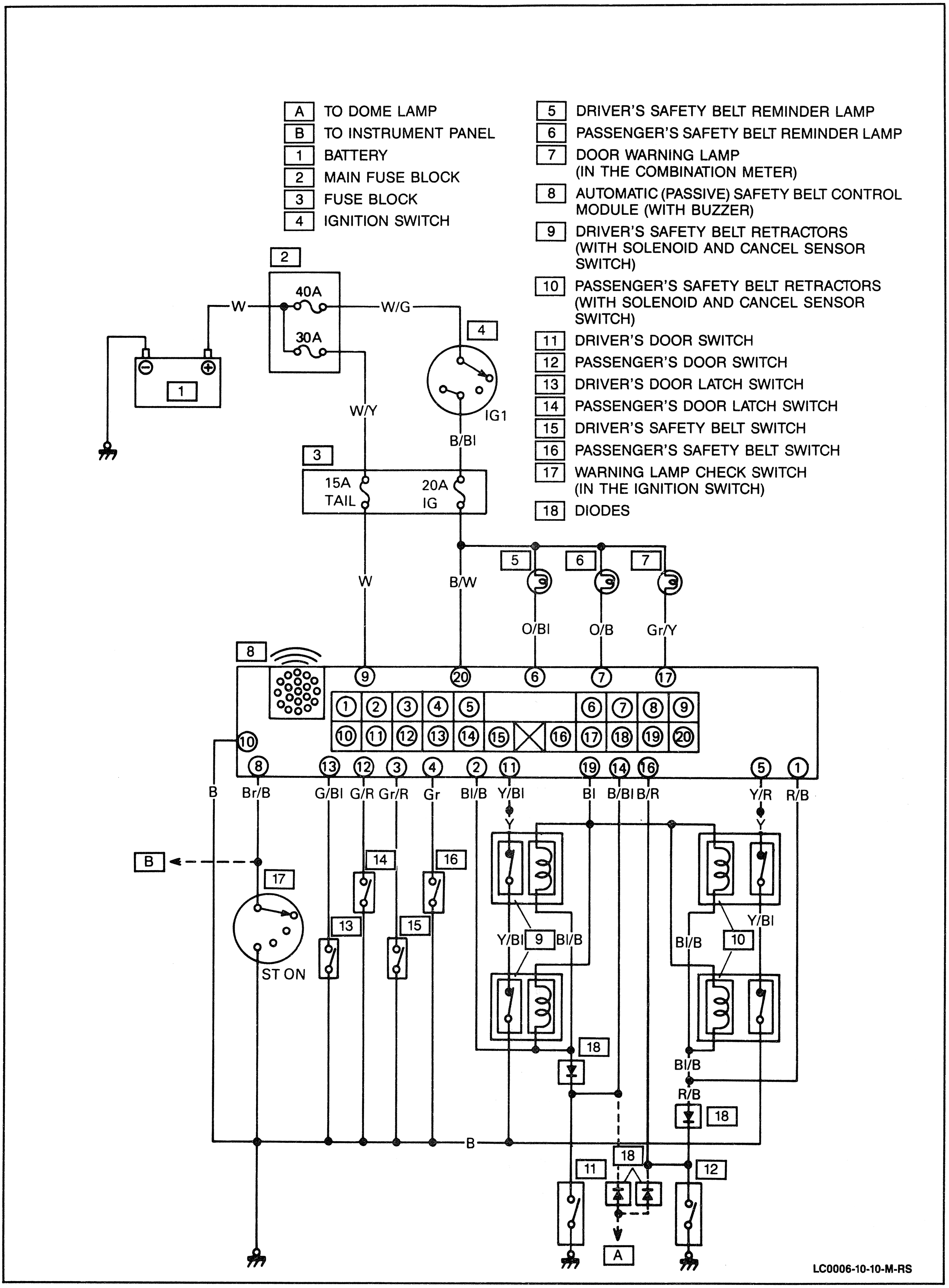
Figure 5 Problem Diagnosis



A	TO DOME LAMP
B	TO INSTRUMENT PANEL
1	BATTERY
2	MAIN FUSE BLOCK
3	FUSE BLOCK
4	IGNITION SWITCH
5	DRIVER'S SAFETY BELT REMINDER LAMP
6	PASSENGER'S SAFETY BELT REMINDER LAMP
7	DOOR WARNING LAMP (IN THE COMBINATION METER)
8	AUTOMATIC (PASSIVE) SAFETY BELT CONTROL MODULE (WITH BUZZER)
9	DRIVER'S SAFETY BELT RETRACTORS (WITH SOLENOID AND CANCEL SENSOR SWITCH)
10	PASSENGER'S SAFETY BELT RETRACTORS (WITH SOLENOID AND CANCEL SENSOR SWITCH)
11	DRIVER'S DOOR SWITCH
12	PASSENGER'S DOOR SWITCH
13	DRIVER'S DOOR LATCH SWITCH
14	PASSENGER'S DOOR LATCH SWITCH
15	DRIVER'S SAFETY BELT SWITCH
16	PASSENGER'S SAFETY BELT SWITCH
17	WARNING LAMP CHECK SWITCH (IN THE IGNITION SWITCH)
18	DIODES

2
40A
30A
W
W/G
W/Y
4
IG1
B/Bl
1
3
15A TAIL
20A IG
W
B/W
5
6
7
O/Bl
O/B
Gr/Y
8
9
20
6
7
17
1 2 3 4 5 6 7 8 9
10 11 12 13 14 15 16 17 18 19 20
10
8
13
12
3
4
2
11
19
14
16
5
1
B
Br/B
G/Bl
G/R
Gr/R
Gr
Bl/B
Y/Bl
Bl
B/Bl
B/R
Y/R
R/B
Y
Y
B
17
ST ON
14
16
13
15
Y/Bl
9
Bl/B
Bl/B
10
Y/Bl
18
Bl/B
R/B
18
B
18
11
12
A
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Figure 6 System Wiring Diagram

CIRCUIT	TERMINAL	STANDARD VOLTAGE	CONDITION
Power	9	10 — 14V	————
	20	0V	Ignition switch "OFF"
		10 — 14V	Ignition switch "ON"
Safety belt retractor solenoid	19	0V	When driver's and passenger's doors are closed
		10 — 14V	When driver's or passenger's door is opened
Driver's door switch	14	4 — 6V	Pull out ignition key, dome lamp switch off, when driver's door is closed
		0V	When driver's door is opened
Passenger's door switch	16	4 — 6V	Dome lamp switch off, when passenger's door is closed
		0V	When passenger's door is opened
Driver's door latch switch	13	0V	When driver's door is opened
		4 — 6V	When driver's door is closed
Passenger's door latch switch	12	0V	When passenger's door is opened
		4 — 6V	When passenger's door is closed
Driver's safety belt switch	3	0V	When driver's safety belt is unbuckled
		10 — 14V	When ignition switch "ON", and driver's safety belt is buckled
Passenger's safety belt switch	4	0V	When passenger's safety belt is unbuckled
		10 — 14V	When ignition switch "ON", and passenger's safety belt is buckled
Driver's retractor cancel sensor switch	11	0V	When driver's door is closed
Passenger's retractor cancel sensor switch	5	0V	When passenger's door is closed
Driver's safety belt reminder lamp	6	0 — 1.5V	When driver's safety belt is unbuckled or driver's door is opened
		10 — 14V	When driver's safety belt is buckled and driver's door is closed
Passenger's safety belt reminder lamp	7	0 — 1.5V	When passenger's safety belt is unbuckled or passenger's door is opened
		10 — 14V	When passenger's safety belt is buckled and passenger's door is closed
Door warning lamp	17	Deflection repeated between 0 and 10 — 14V	When driver's or passenger's door is opened
		10 — 14V	When driver's and passenger's doors are closed
Warning lamp check switch	8	10 — 14V	When ignition switch "ON", driver's and passenger's doors are closed
		0V	Ignition switch "START"

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Figure 7 Voltage Check Chart

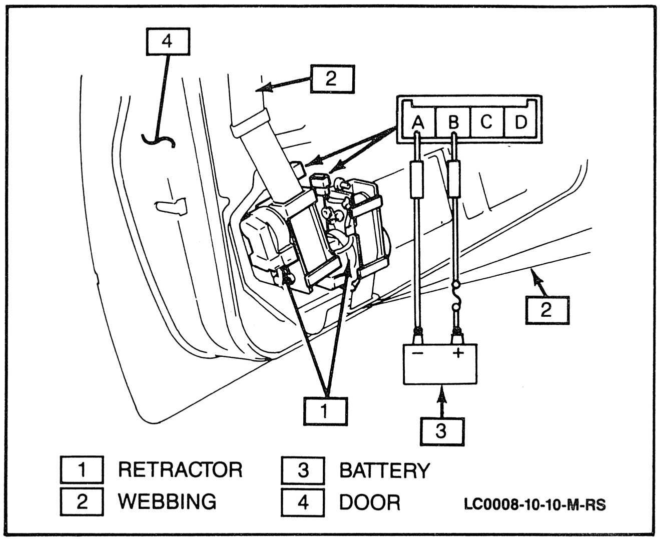


Figure 8 Retractor Diagnosis

Inspect

Tool Required:
J 34029-A Digital Multimeter

1. Webbing to ensure that it is free from cuts or damage.
2. Safety belt and buckle for secure connection.

- Pull webbing sharply out of retractor. Retractor should lock webbing and prevent further release until tension is relieved.
- Connect a fused jumper from a battery positive (+) source to safety belt assembly connector cavity B. Connect another jumper from safety belt assembly connector cavity A to chassis ground. With jumpers connected and retractor solenoids energized, the retractor should not lock the safety belt webbing. If webbing locks, replace the safety belt assembly (Figure 8).

Measure

Tool Required:
J 34029-A Digital Multimeter

- Resistance between cavities C and D with retractor solenoid de-energized (Figure 8). If resistance is more than 0.3 ohms, replace safety belt assembly.

Install or Connect

1. Safety belt assembly, retractor fixing bolt and nuts.

Tighten

- Retractor fixing bolts and nuts to 35 N·m (26 lb.ft.).

2. Retractor lead wire.
3. Lap belt anchor bolt.

Tighten

- Lap belt stud to 3.5 N·m (26 lb.ft.).

4. Shoulder bracket and then shoulder bolt stud.

Tighten

- Shoulder bolt stud to 5.5 N·m (49 lb.in.).

5. Door panel.

AUTOMATIC SAFETY BELT CONTROL MODULE

Figure 7

Important

- The automatic safety belt control module is a solid state component. Do not measure resistance.

Remove or Disconnect

- Automatic safety belt control module from the LH Instrument Panel reinforcement.

Measure

Tool Required:
J 34029-A

- Voltage at each cavity of automatic safety belt control module connector. If observed voltage is not within allowable tolerance, make necessary electrical repairs (Figure 7).

Install or Connect

- Automatic safety belt control module to LH Instrument Panel reinforcement.

SAFETY BELT SWITCH

Figure 9

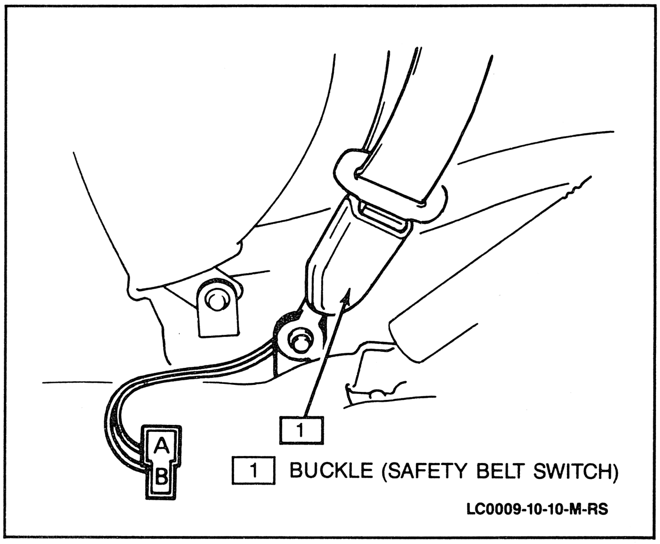


Figure 9 Safety Belt Switch

Remove or Disconnect

- Safety belt switch connector.

Measure

Tool Required:
J34029-A

- Resistance between cavities A and B with safety belt not buckled (Figure 9). If resistance exceeds 0.3 ohms, replace safety belt switch.

Install or Connect

- Safety belt switch connector.

DOOR SWITCH

Figure 10

Door switches also control dome lamp operations. Set dome lamp switch to "DOOR" position and check that dome lamp lights when either door is opened. If not, perform following procedure.

Remove or Disconnect

1. Door switch.
2. Door switch connector.

Measure

Tool Required:
J 34029-A Digital Multimeter

- Resistance between connector cavity and spring plate with switch in door open position (Figure 10). If resistance exceeds 0.3 ohms, replace door switch.

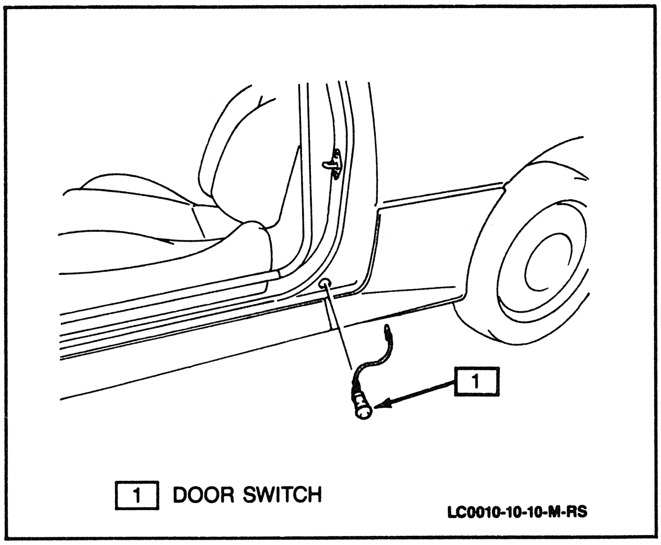


Figure 10 Door Switch

Install or Connect

1. Door switch connector.
2. Door switch.

DOOR LATCH SWITCH

Figure 11

Remove or Disconnect

1. Door trim panel.
2. Vinyl sheet.
3. Door latch switch connector.

Measure

Tool Required:
J 34029-A Digital Multimeter

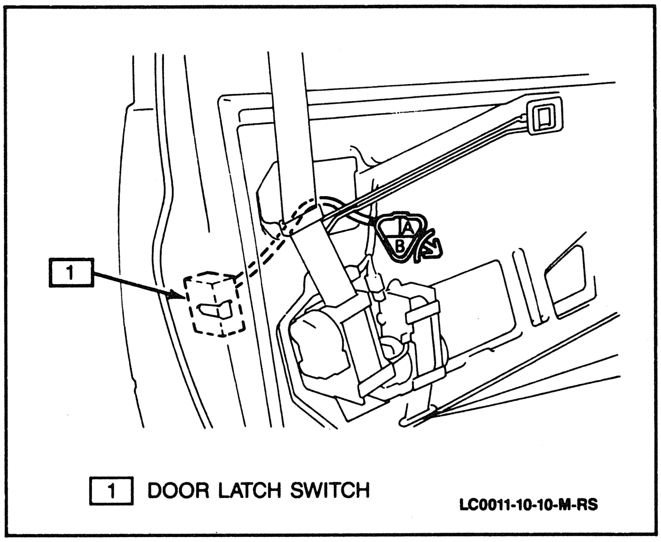


Figure 11 Door Latch Switch

- Resistance between cavities A and B with door open (Figure 11). If resistance measures in excess of 0.3 ohms, replace door latch switch.

Install or Connect

1. Vinyl sheet.
2. Door trim panel.

WARNING LAMP CHECK SWITCH

Figure 12

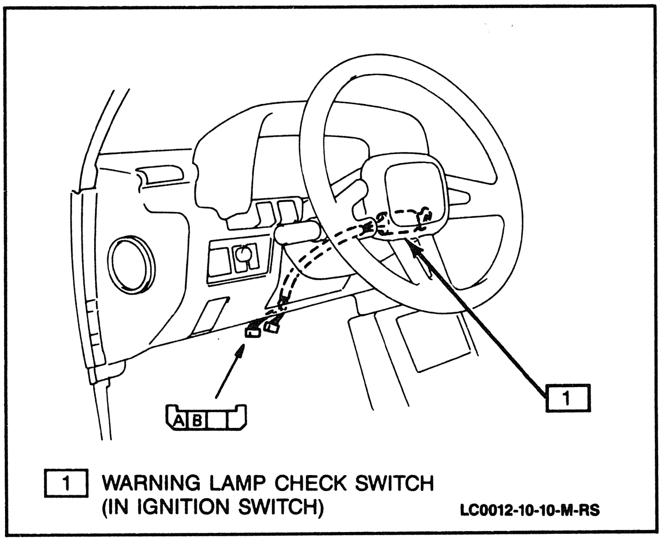


Figure 12 Warning Lamp Check Switch

Remove or Disconnect

- Ignition switch connector.

Measure

Tool Required:

J 34029-A Digital Multimeter

- Resistance between cavities A and B with ignition switch in the "START" position with a J 34029-A digital multimeter. If resistance measures more than 0.3 ohms, replace warning lamp check switch (Figure 12).

Install or Connect

- Ignition switch connector.

DIODE

Figure 13

Remove or Disconnect

1. Battery negative (-) cable.
2. Automatic safety belt control module connector.

Measure

Tool Required:

J 34029-A Digital Multimeter

- Continuity between cavities 2 and 14, 1 and 16 with a J 34029-A digital multimeter, reversing meter leads each time to ensure that continuity exists in only one direction (Figure 13).
- If continuity does not exist in either direction, or exists in both directions, replace diodes.

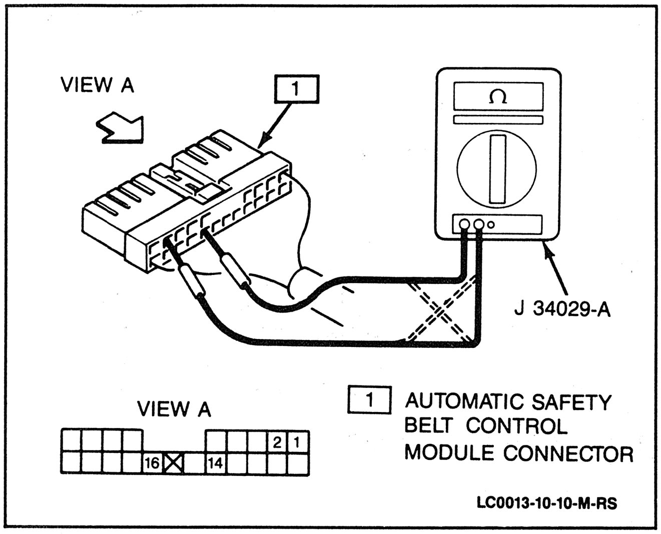


Figure 13 Diode

Install or Connect

1. Automatic safety belt control module.
2. Battery negative (-) cable.

Tighten

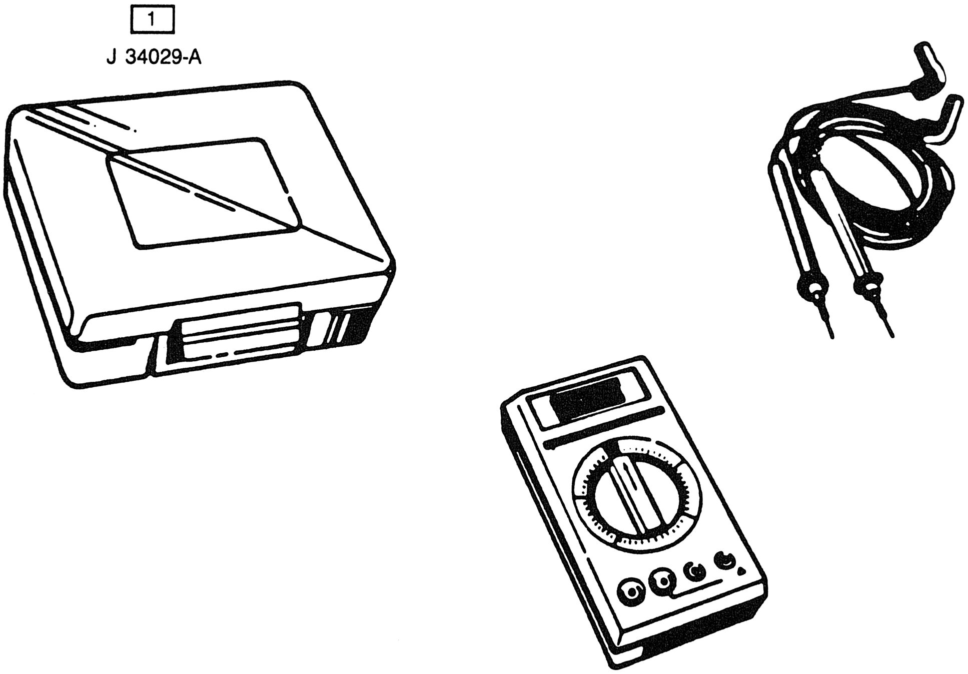
- Battery negative (-) cable to 12 N·m (106 lb. in.).

SPECIFICATIONS

FASTENER TORQUES

Retractor Fixing Bolts and Nuts	35 N·m (26 lb.ft.)
Lap Belt Anchor Bolt	35 N·m (26 lb.ft.)
Shoulder Belt Stud	5.5 N·m (49 lb.in.)
Battery Negative (-) Cable	12 N·m (106 lb.in.)

SPECIALS TOOLS



1 HIGH IMPEDANCE DIGITAL MULTIMETER

KC0003-6D1-S-RS

SECTION 10-11

BODY ELECTRICAL SYSTEMS

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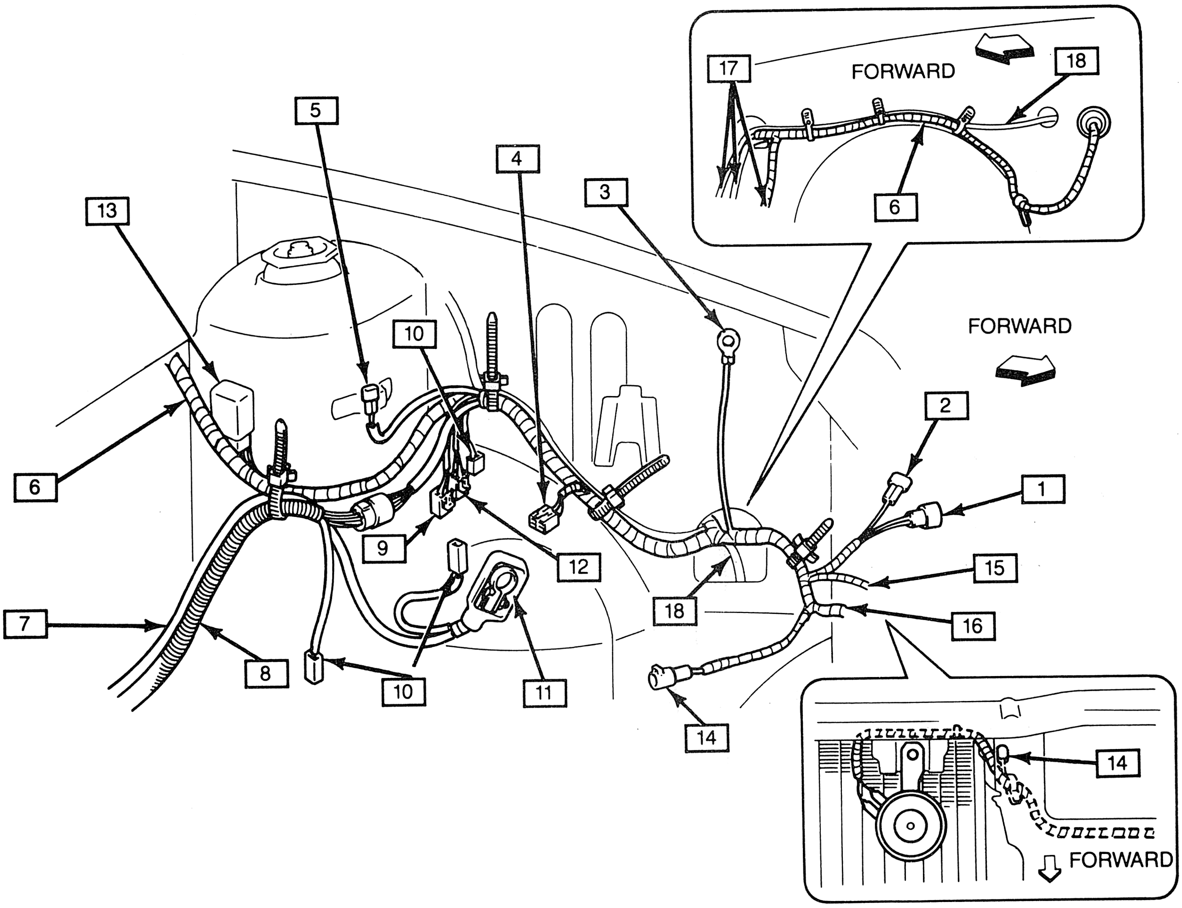
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2
1
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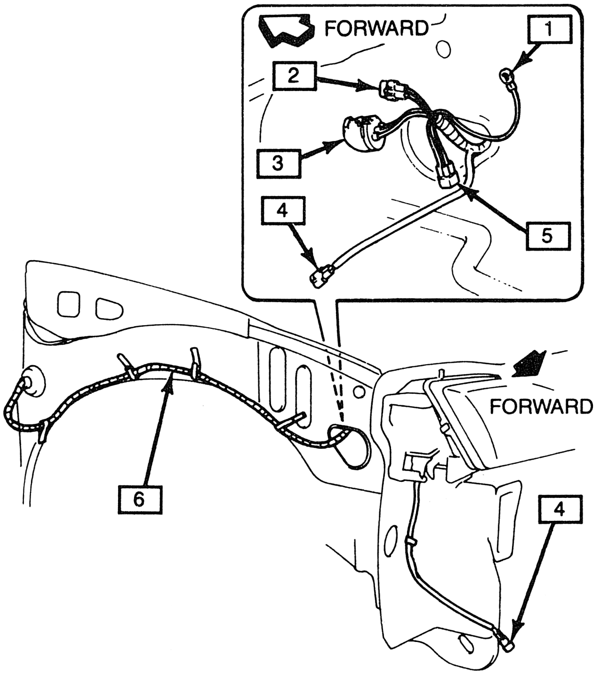
10
11
14
14
FORWARD

1	TO HEADLIGHT
2	TO PARKING LIGHT
3	GROUND
4	TO HORN RELAY
5	TO EFI FUSE
6	MAIN WIRING HARNESS NO. 1
7	STARTER MOTOR CABLE
8	ENGINE WIRING HARNESS NO. 5
9	TO FUEL PUMP RELAY
10	TO MAIN FUSE
11	TO POSITIVE BATTERY TERMINAL
12	TO MAIN RELAY
13	NOISE SUPRESSER
14	TO RADIATOR FAN MOTOR
15	TO TURN SIGNAL LIGHT
16	TO HORN
17	TO WASHER PUMP
18	WASHER HOSE

KC1407-10-11-M-RS

Figure 1 Left Side Fender Apron Wiring



1 GROUND
2 TO PARKING LIGHT
3 TO HEADLIGHT
4 TO TURN SIGNAL
5 TO AIR CONDITIONING WIRING HARNESS (OPTIONAL)
6 MAIN WIRING HARNESS NO. 1

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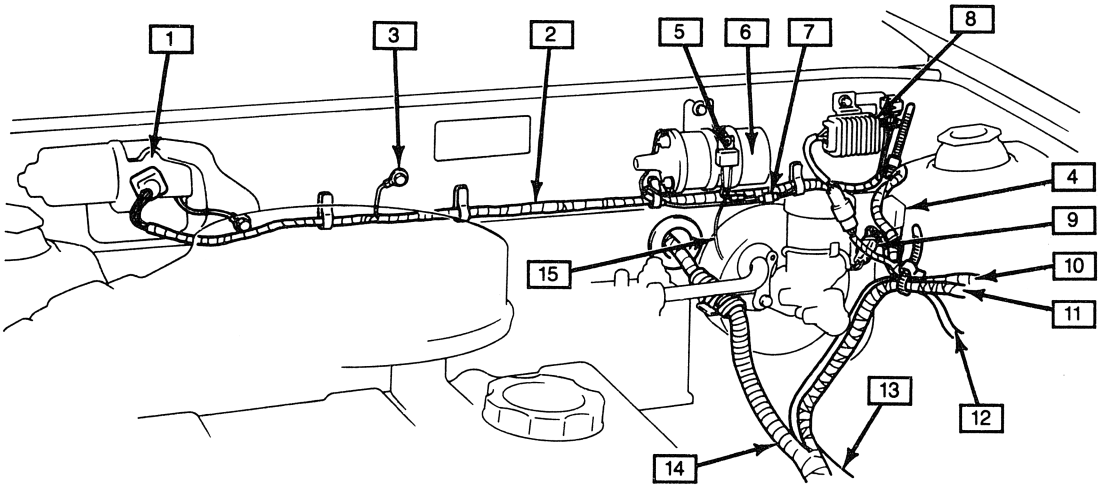
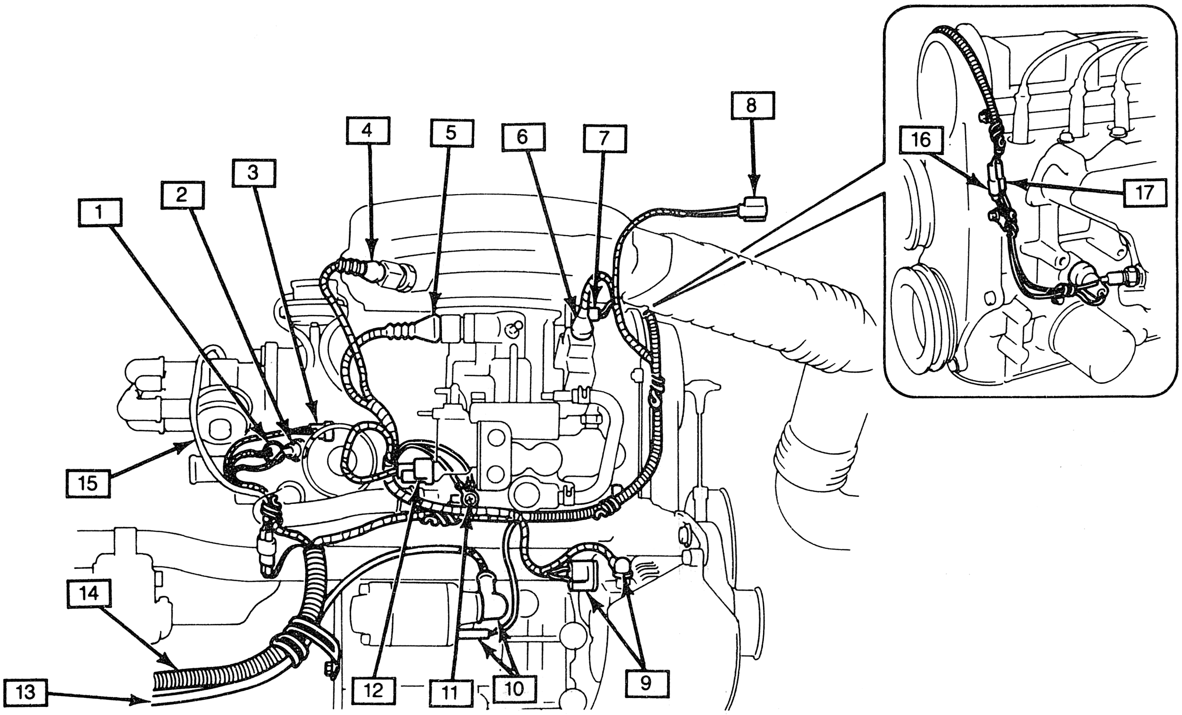
Figure 2 Right Side Inner Fender Wiring



1 WIPER MOTOR
2 MAIN WIRING HARNESS NO. 1
3 GROUND
4 NOISE SUPRESSER
5 CONDENSER
6 IGNITION COIL
7 MONITOR CONNECTOR FOR EFI SYSTEM
8 RESISTOR
9 TO BRAKE FLUID LEVEL SWITCH
10 TO LEFT HEADLIGHT, TURN SIGNAL AND PARKING LIGHT
11 TO MAIN FUSE
12 TO POSITIVE BATTERY TERMINAL
13 TO STARTER MOTOR
14 ENGINE WIRING HARNESS NO. 5
15 TO GROUND

KC1409-10-11-M-RS

Figure 3 Cowl Top Panel Wiring



1 RADIATOR COOLING FAN MOTOR SWITCH

2 COOLANT TEMPERATURE GAGE SENDING UNIT

3 EXHAUST GAS RECIRCULATION VACUUM SWITCHING VALVE

4 AIR TEMPERATURE SENSOR

5 COOLANT TEMPERATURE SENSOR

6 THROTTLE POSITION SWITCH (MANUAL TRANSMISSION VEHICLES) THROTTLE POSITION SENSOR (AUTOMATIC TRANSMISSION VEHICLES)

7 FUEL INJECTOR

8 MANIFOLD ABSOLUTE PRESSURE SENSOR CONNECTOR

9 GENERATOR CONNECTIONS

10 STARTER MOTOR CONNECTIONS

11 GROUND CONNECTION

12 IDLE SPEED CONTROL SOLENOID VALVE

13 BATTERY POSITIVE TERMINAL

14 ENGINE WIRING HARNESS

15 DISTRIBUTOR WIRING

16 OXYGEN SENSOR CONNECTOR

17 OIL PRESSURE SWITCH CONNECTOR

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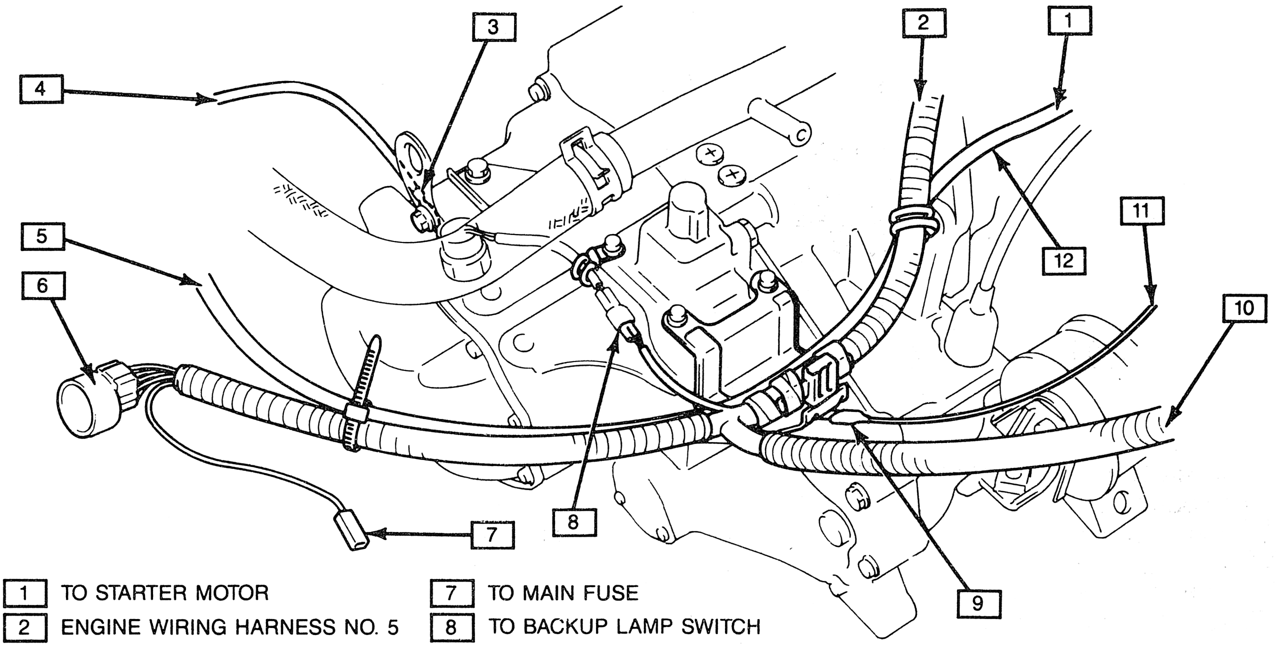
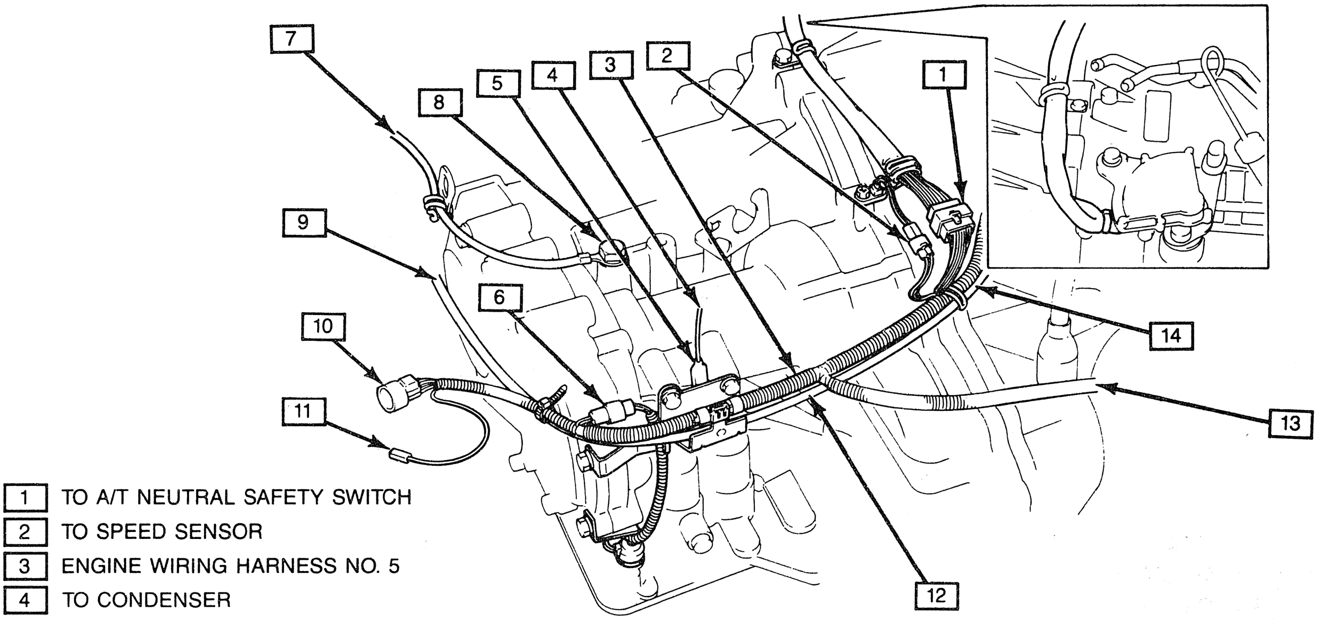
Figure 4 Engine Wiring



1 TO STARTER MOTOR
2 ENGINE WIRING HARNESS NO. 5
3 BATTERY GROUND
4 TO NEGATIVE BATTERY TERMINAL
5 TO POSITIVE BATTERY TERMINAL
6 TO MAIN WIRING HARNESS NO.1
7 TO MAIN FUSE
8 TO BACKUP LAMP SWITCH
9 GROUND
10 TO ENGINE CONTROL MODULE
11 TO CONDENSER
12 STARTER MOTOR CABLE

KC1411-10-11-M-RS

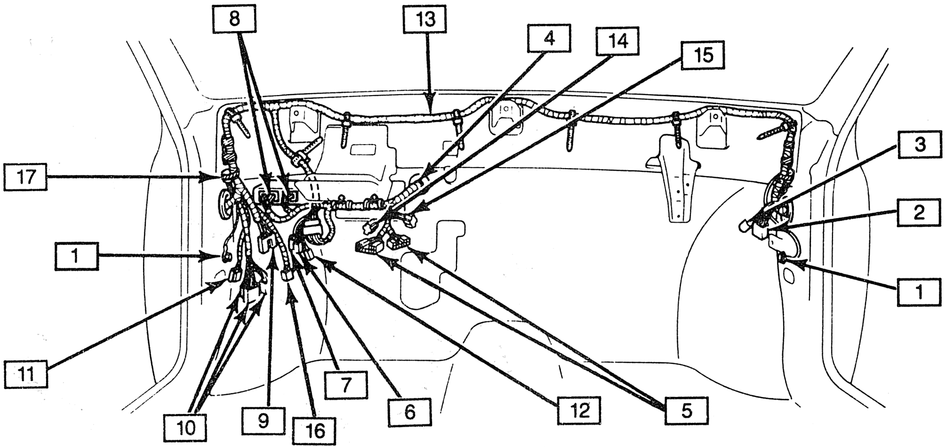
Figure 5 Manual Transmission Wiring



1 TO A/T NEUTRAL SAFETY SWITCH
2 TO SPEED SENSOR
3 ENGINE WIRING HARNESS NO. 5
4 TO CONDENSER
5 GROUND
6 TO A/T SHIFT SOLENOID
7 TO NEGATIVE BATTERY TERMINAL
8 BATTERY GROUND
9 TO POSITIVE BATTERY TERMINAL
10 TO MAIN WIRING HARNESS NO. 1
11 TO MAIN FUSE
12 STARTING MOTOR CABLE
13 TO ENGINE CONTROL MODULE AND A/T CONTROL MODULE
14 TO STARTER MOTOR

KC1412-10-11-M-RS

Figure 6 Automatic Transmission Wiring



1	GROUND
2	TO AIR CON. WIRING HARNESS (OPTIONAL)
3	TO DOME LIGHT
4	ENGINE WIRING HARNESS NO. 5
5	TO A/T CONTROL MODULE (FOR A/T MODEL ONLY)
6	TO STOP LIGHT SWITCH
7	TO CLUTCH START SWITCH (FOR M/T MODEL ONLY)
8	TO ELECTRICAL CONTROL MODULE
9	TO INSTRUMENT PANEL WIRING HARNESS NO. 2
10	TO JUNCTION BLOCK
11	TO FLOOR WIRING HARNESS NO. 3
12	TO WIPER/WASHER SWITCH
13	MAIN WIRING HARNESS NO. 1
14	MONITOR COUPLER FOR A/T CONTROL MODULE
15	DIAG SWITCH COUPLER FOR A/T CONTROL MODULE
16	TO AUTOMATIC (PASSIVE) SAFETY BELT CONTROL MODULE
17	DIODES

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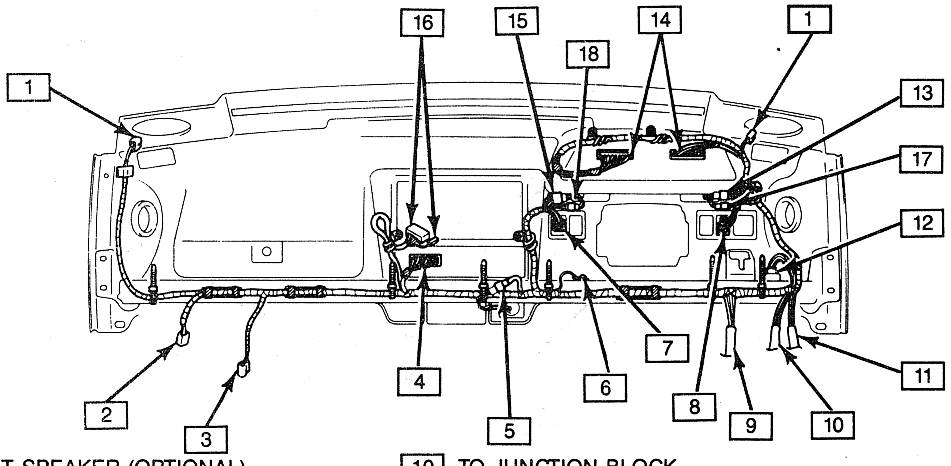
Figure 7 Cowl Upper Wiring



1	TO FRONT SPEAKER (OPTIONAL)
2	TO BLOWER RESISTER
3	TO BLOWER MOTOR
4	TO HEATER FAN SWITCH
5	TO CIGAR LIGHTER (OPTIONAL)
6	GROUND
7	TO REAR WIPER/WASHER SWITCH (IF EQUIPPED)
8	TO ILLUMINATION CONTROLLER (IF EQUIPPED)
9	TO FLOOR WIRING HARNESS NO. 3
10	TO JUNCTION BLOCK
11	TO MAIN WIRING HARNESS NO. 1
12	TO WIRING CONTROLLER/BUZZER
13	TO FRONT FOG LIGHT SWITCH
14	TO COMBINATION METER
15	TO REAR DEFOGGER SWITCH (IF EQUIPPED)
16	TO RADIO (OPTIONAL)
17	TO DRIVER'S SAFETY BELT REMINDER LIGHT
18	TO PASSENGER'S SAFETY BELT REMINDER LIGHT

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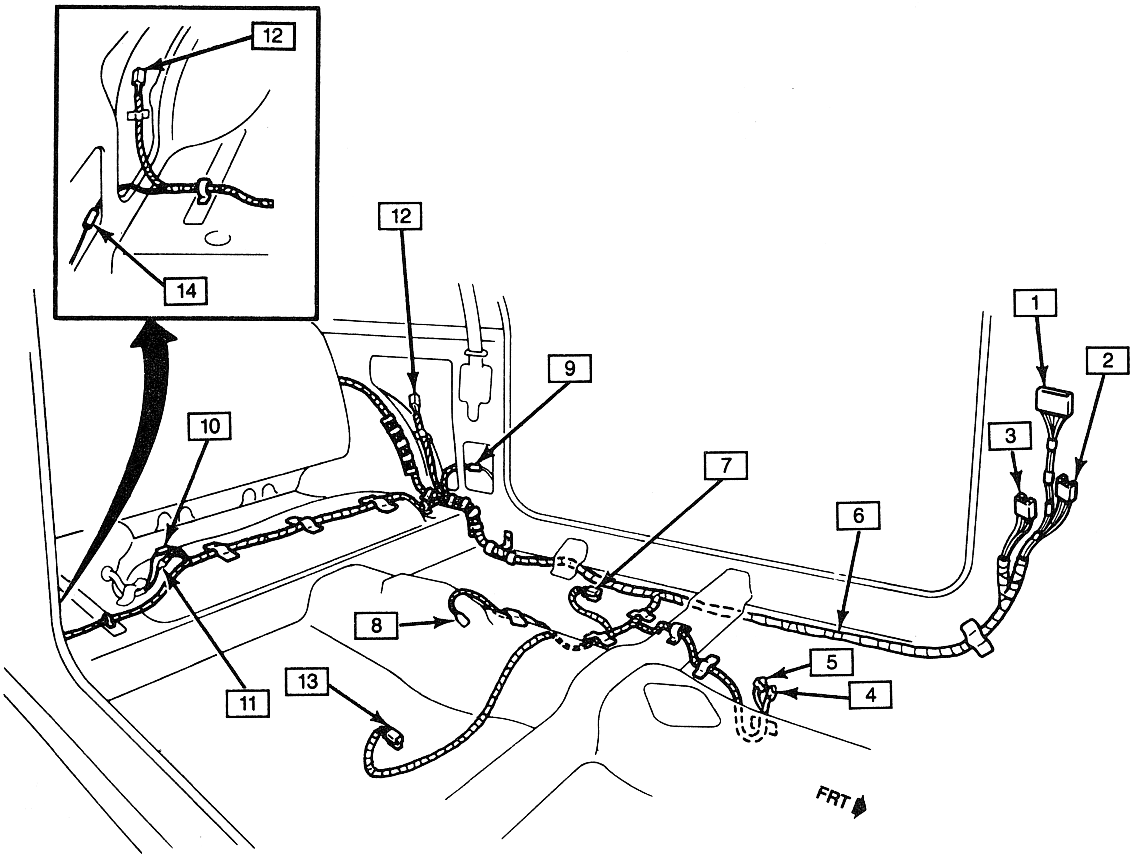
Figure 8 Instrument Panel Wiring



1	TO INSTRUMENT PANEL WIRING HARNESS NO. 2
2	TO JUNCTION BLOCK
3	TO MAIN WIRING HARNESS NO. 1
4	TO A/T SHIFT ILLUMINATION LIGHT (FOR A/T MODEL ONLY)
5	TO A/T SHIFT LOCK SOLENOID (FOR A/T MODEL ONLY)
6	FLOOR WIRING HARNESS NO. 3
7	TO DRIVER'S SAFETY BELT SWITCH
8	TO PARKING BRAKE SWITCH
9	TO DRIVER'S DOOR SWITCH
10	TO FUEL LEVEL GAUGE UNIT
11	TO FUEL PUMP
12	TO REAR SPEAKER (OPTIONAL)
13	TO PASSENGER'S SAFETY BELT SWITCH
14	TO PASSENGER'S DOOR SWITCH

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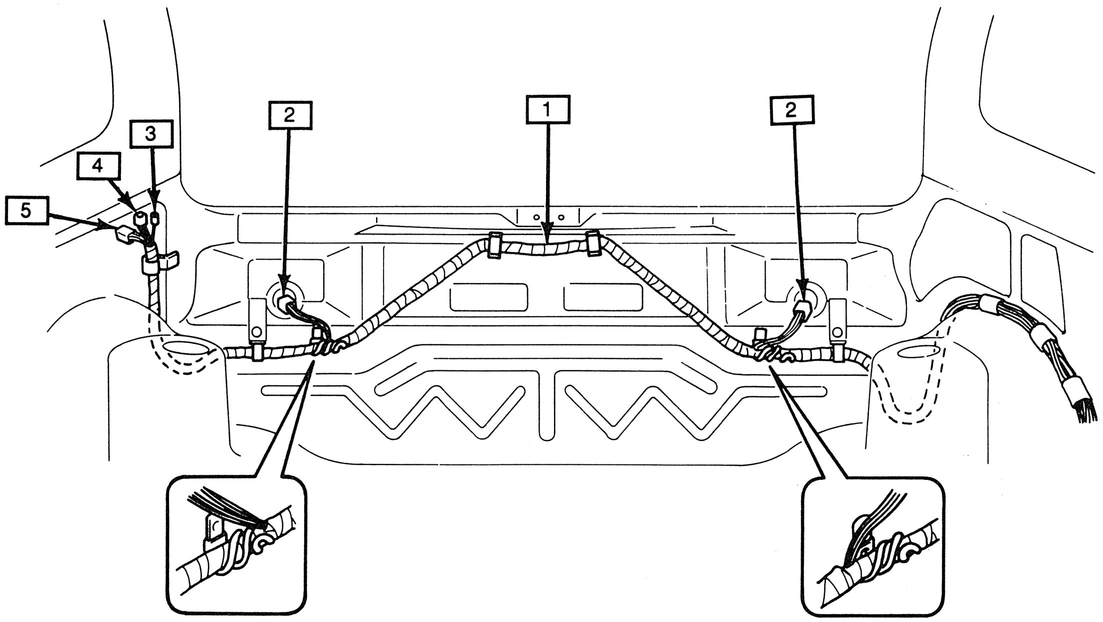
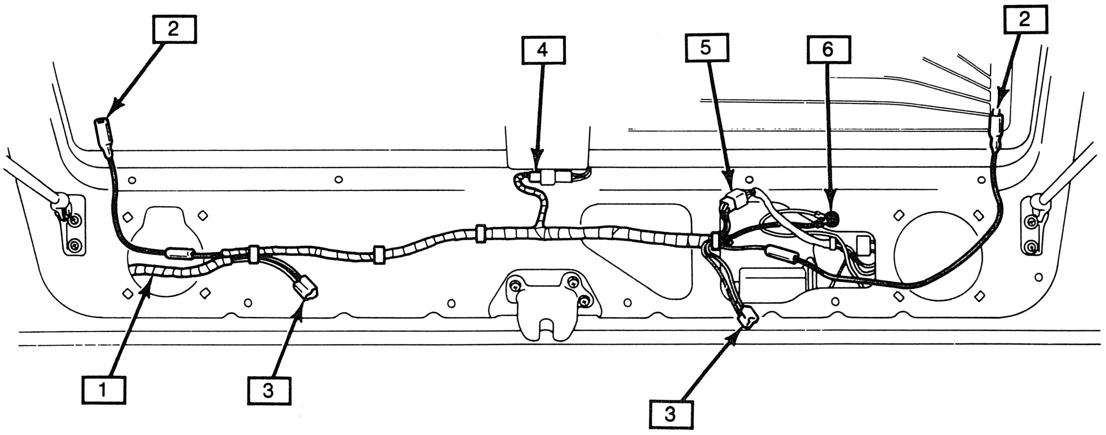
Figure 9 Floor Wiring



1 FLOOR WIRING HARNESS NO. 3
2 TO REAR COMBINATION LIGHT
3 TO HIGH-MOUNTED STOPLAMP
4 TO REAR WIPER MOTOR (OPTIONAL)
5 TO REAR SPEAKER (OPTIONAL)

KC1416-10-11-M-RS

Figure 10 Rear Body Wiring



1 FROM FLOOR WIRING HARNESS NO. 3
2 TO REAR DEFOGGER (OPTIONAL)
3 TO REAR SPEAKER (OPTIONAL)
4 TO HIGH-MOUNTED STOPLAMP
5 TO REAR WIPER MOTOR (OPTIONAL)
6 GROUND

KC1417-10-11-M-RS

Figure 11 Back Door Wiring

GROUNDING POINTS

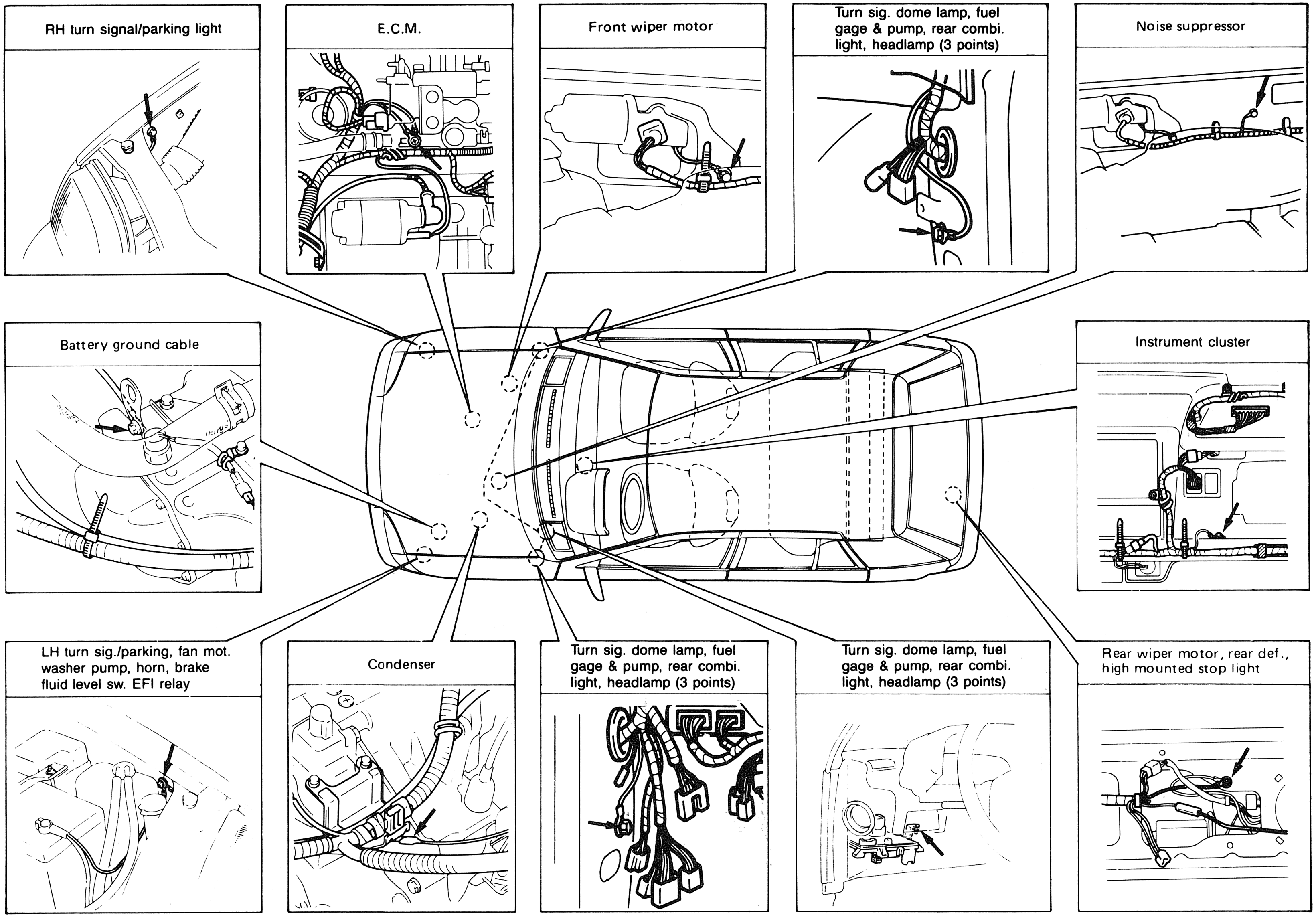
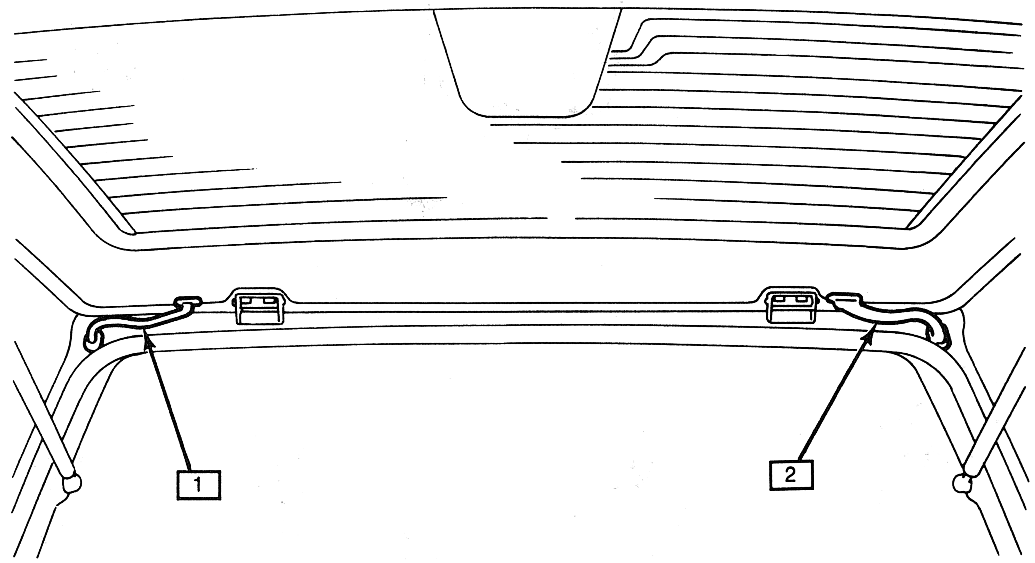

RH turn signal/parking light
E.C.M.
Front wiper motor
Turn sig. dome lamp, fuel gage & pump, rear combi. light, headlamp (3 points)
Noise suppressor
Battery ground cable
Instrument cluster
LH turn sig./parking, fan mot. washer pump, horn, brake fluid level sw. EFI relay
Condenser
Turn sig. dome lamp, fuel gage & pump, rear combi. light, headlamp (3 points)
Turn sig. dome lamp, fuel gage & pump, rear combi. light, headlamp (3 points)
Rear wiper motor, rear def., high mounted stop light

Figure 12 Grounding Points

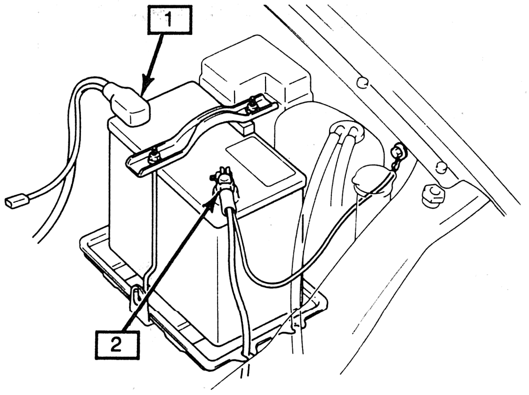
KC1420-10-M-RS



1 REAR WASHER HOSE (OPTIONAL)
2 REAR DEFOGGER WIRING (OPTIONAL)

KC1418-10-11-M-RS

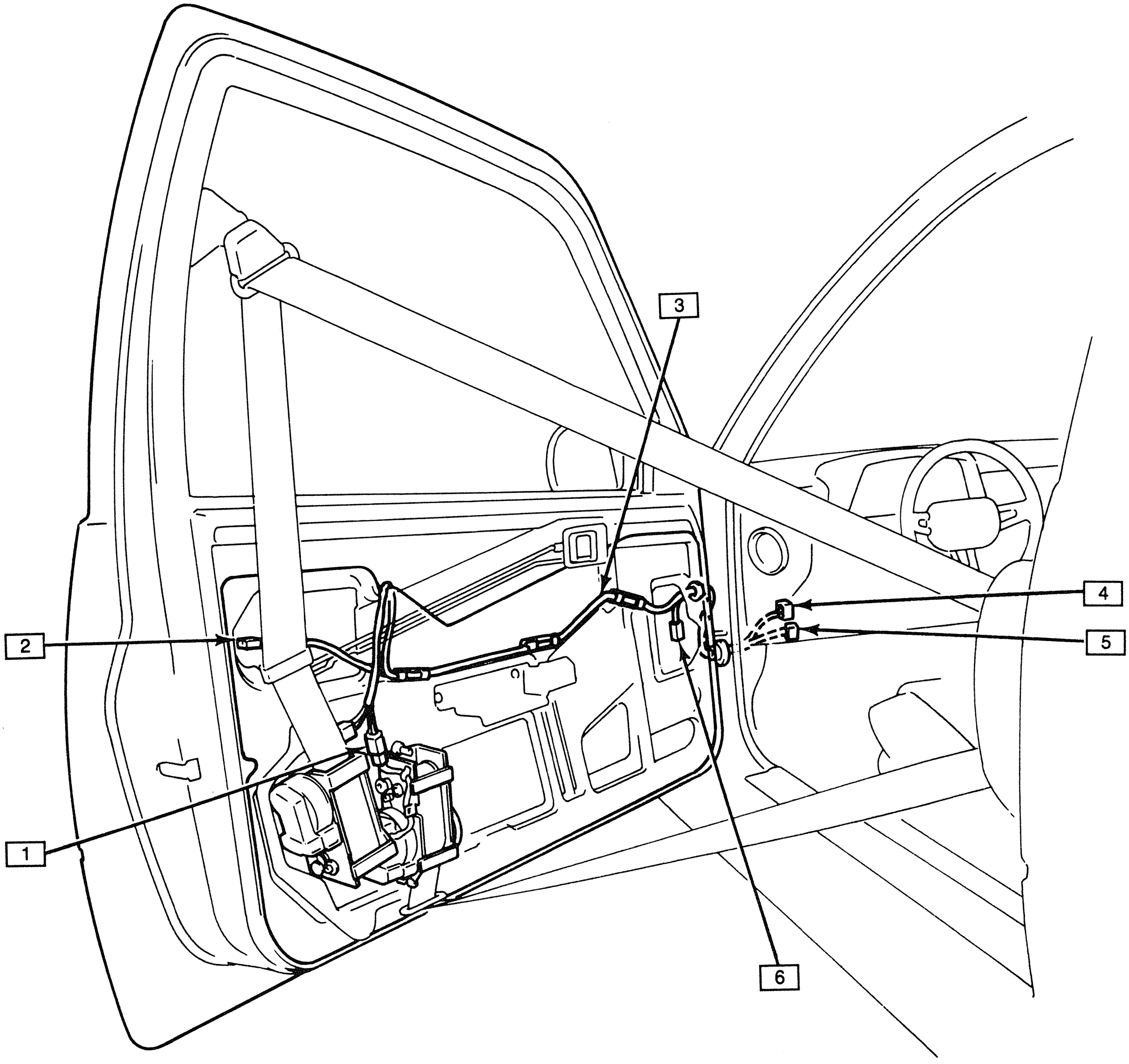
Figure 13 Rear Glass Wiring



1 POSITIVE TERMINAL
2 NEGATIVE TERMINAL

KC1419-10-11-M-RS

Figure 14 Battery



1 TO RETRACTORS
2 TO DOOR LATCH SWITCH
3 DOOR LEAD WIRE
4 TO WIRING HARNESS NO. 1
5 TO POWER MIRROR WIRE (IF EQUIPPED)
6 TO MIRROR MOTOR (IF EQUIPPED)

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Figure 15 Front Door Wiring

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